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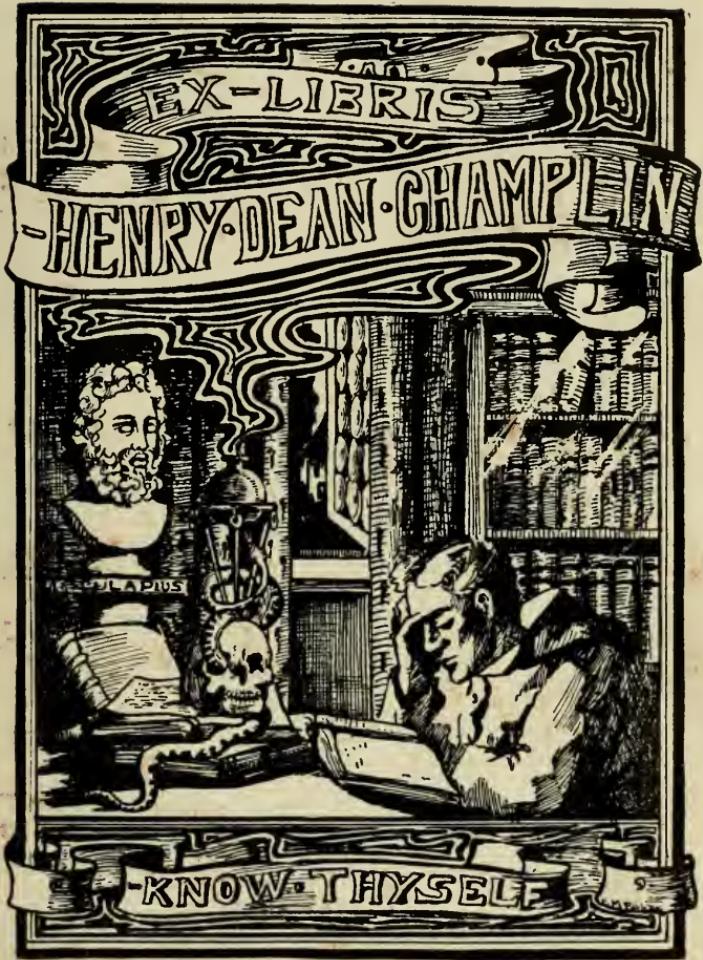


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ELECTRICITY.

ELECTRICITY

—IN—

MEDICINE AND SURGERY

—BY—

GEO. C. PITZER, M. D.,

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AUTHOR OF "DIRECT MEDICATION;" AND "ALCOHOL AS A
FOOD, A MEDICINE, A POISON AND AS A LUXURY."

THIRD EDITION.

ST. LOUIS, MO.

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PREFACE.

The object of this work is to furnish the medical student with a book containing the principal practical facts embraced by the subject of electricity and electro-therapeutics. We have aimed to make everything as plain and simple as possible, so that a mere novice may, with the aid of this book, commence the use of electricity in the treatment of disease. We hope it may supply a want expressed by country practitioners generally.

GEO. C. PITZER.

ST. LOUIS, January, 1883.

PREFACE TO SECOND EDITION.

Although upon the market but a few weeks, the first edition of this work is already exhausted. This unexpected demand, together with the hearty appreciation and warm approval of this little book, as manifested and expressed by leading members of all branches of the medical profession, has encouraged us to immediately get out this second edition.

It will be observed that the work has been thoroughly revised, and considerably enlarged, by the addition of several new chapters, embracing some of the most interesting subjects connected with electrical therapeutics. Of these we mention electro-diagnosis; how to detect feigned sickness or malingering; how to make tests for life or death in doubtful cases; how to revive people suffering from asphyxia, or from over doses of chloroform taken by inhalation; how to restore those who are suffering from opium or morphia poison, and how to cauterize with electricity. And static or Franklinic electricity is treated in detail, the best machines for its use fully explained and clearly illustrated.

Our own experience is given in all cases where we have actual knowledge of facts; and the experience of other reliable men, such as Morton, Bartholow, Curtiss, Rockwell, etc., is added or appended in many instances, due credit being attached where it belongs. Speculative theories and reckless reports from doubtful sources are strenuously avoided. We have endeavored to furnish our readers with an honest, clear and comprehensive exposition of electro-therapeutics, that may enable them to apply this measure in practice in all cases where it may be available. Hoping our efforts may prove satisfactory, and that the work may be studied with care and profit, and thanking our many readers and reviewers for their unsolicited expressions of praise in the favorable mention of our first effort, we now place before the profession this second edition.

GEO. C. PITZER.

ST. LOUIS, MAY 1st, 1883.

PREFACE TO THIRD EDITION.

Within one year two editions of this work have been sold, and with the beginning of 1884 another thousand is called for.

We have carefully revised the work, and made such additions as have seemed most essential. New chapters on static electricity, impotency, electrolysis in urethral stricture, and special instructions in the treatment of chorea, are added, with illustrations of some valuable electrical machines and batteries. The work speaks for itself, and we hope it may give even better satisfaction than ever before.

GEO. C. PITZER.

ST. LOUIS, MARCH, 1884.

Electricity in Medicine and Surgery.

ELECTRICITY AND ELECTRICAL APPARATUS.

Electricity is a force or mode of motion, which may be generated by friction or by chemical action. No chemical change can take place without the evolution of more or less electricity.

The application of this agent, in some form, to the relief and cure of disease dates back many years. At one time frictional or Franklinic electricity was very popular, a number of accidental cures resulting from its use. We say *accidental* cures because they resulted from the empirical use of electricity, no regard being paid to any law upon which the cures were wrought.

An interesting treatise on Franklinic electricity, written by Rev. John Wesley in 1759, gives the reader a very good understanding of the position of electro-therapeutics more than a hundred years ago. Medical men at that time seemed to be inclined to turn away from this new agent; this placed it in the hands of the laity, where it was resorted to for all kinds of ailments. This indiscriminate use of a potent agent, chiefly by men and women who knew but little about it, could but result in failure. Because electricity did not, in the hands of quacks, cure everything, it was denounced entirely by many, and rapidly fell into disrepute; and to this day, while it has many able advocates, in and out of the profession, there are not a few who entertain strong prejudices against it. It is a fact that electricity will not cure everything, no matter in what form, how used, or by whom it is applied. While it is indicated in some form in a wide range of disorders, and while many distressing ailments are speedily relieved and others rapidly and radically cured, it fails in many instances. But where we have cases to which this agent is adapted and we rightly apply it, nothing equals it.

Like everything else, electricity has its place and its power, and

in its place it is prompt and positive in its effects. It is scarcely worth while to say that the principal reason of many failures in the use of electricity is to be found in the fact that many who try to use this agent do not understand the instruments they undertake to operate. They know but little about the principles of their workings, and they too frequently know even less about anatomy, physiology and pathology. It is folly to hope for good results from any therapeutic agent in the hands of an ignoramus, unless it be by accident. A successful electrician must be an educated physician. He must understand physiology and pathology, then he may commence the study of electro-therapeutics and the use of electrical instruments. Taking it for granted, then, that our readers are all physicians, we hope to make our lessons interesting, instructive and practical.

Electricity, in the abstract, is always the same, no matter where or how generated; but its effects upon the human system are greatly varied, and wonderfully modified by the different modes of application and through the instruments used in generating and conducting it to and into the body. For example: By the judicious use of Franklinic electricity a stimulating and tonic influence is imparted, the nutrition of the part is improved and the nervous system is invigorated. By the application of the Faradic, or induced current, we stimulate or excite with the negative pole, and soothe or relieve excitement and pain with the positive pole. With the simple galvanic current we excite or soothe, as in the case of the Faradic current; but we may do even more than this. We can, by using this current properly, actually separate the constituents of the tissues, the acids and oxygen of the part going to the positive pole, while the alkalies and hydrogen go to the negative pole. This is called electrolysis, and in this way enlarged glands, indurated tumors and soft tumors are frequently dissolved and rapidly carried away. Again, if we close a galvanic current with a platinum wire, and apply the wire to a part, we may speedily burn it to a crisp. Or, by surrounding a part by this wire, we may remove it entire. This is called the galvanic cautery, by which we frequently remove tumors. The operation is bloodless, and the healing process rapid. But these are mere hints illustrating the different results of electricity, as applied in different forms and through different means.

Before going further, we can best serve our purpose and that of the reader by presenting a short description of the different forms of electricity and a few brief illustrations of some of the most practical batteries and instruments used in electro-therapeutics. As we become familiar with the different forms, and the instruments used in generating and conducting electricity, we are better qualified to understand its therapeutic application.

Electricity is manifested in three general forms: Magnetism, Franklin electricity and Galvanism.

Magnetism is that form of electricity found in loadstone. Loadstone is an iron ore, which, as above intimated, is permanently charged with electricity, and is called a natural magnet. Ordinary steel bars may be charged with electricity, when they become artificial magnets. They may be charged or magnetized, as it is called, by bringing them in contact with a natural magnet, or they may be magnetized by the galvanic current, to be hereafter described. In either case these steel bars are only artificial magnets, and in time lose more or less of their electricity, or magnetic influence. But good, hard steel will retain its magnetic power for a long time. If pure soft iron bars are magnetized by a natural magnet, or by the galvanic current, while they remain in contact with the natural magnet or with the galvanic current, they are magnets themselves; but when these bars thus made magnetic are removed from the natural magnet or the galvanic current, they at once lose their magnetic power.

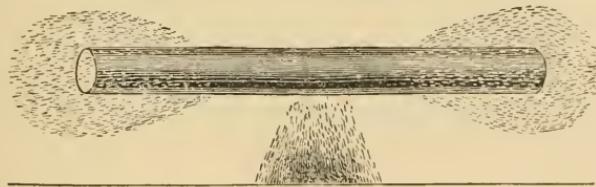


Fig. 1.

There is a property belonging to magnets called polarity. The ends of a magnetic rod of steel attract iron and iron filings, as illustrated by Fig. 1. But this same iron, or iron filings, placed upon the center of this magnet, immediately fall off, as above illustrated. It is evident that two opposite kinds of magnetism are manifested in this rod; one kind at the ends of the magnet and another

at its center. These points, manifesting opposite kinds of magnetism, are called poles. This property, polarity, belongs to other forms of electricity, and is a peculiarity of this *mode of motion*. More might be said here about magnetism, but this is quite enough to serve our purpose for the present. When we come to describe the Faradic current, this form of electricity will be referred to again.

Franklinic or static electricity is obtained by friction, cleavage and pressure. Quite a number of machines are in use for the generation of this kind of electricity, and there are numerous cases in therapeutics where this form of this force is equal to others, even much better; then there are many cases where other forms are far superior. For good reasons Franklinic electricity is being extensively used in therapeutics at the present day.

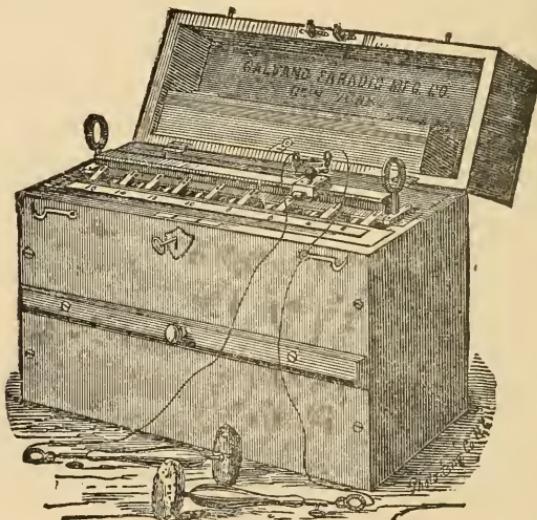


Fig. 2.

Galvanism, or electricity generated by chemical action, is the form in which this great force can be best utilized in therapeutics, and to this form does electricity owe its great popularity. For the evolution of electricity by chemical action, a galvanic battery is required, and we can make this part of our subject more intelligible by taking a battery in common use for illustration. Stohrer's famous galvanic battery, as made by the Galvano-Faradic Manufacturing Company, of New York, will answer a fine purpose.

Fig. 2 represents Stohrer's galvanic battery. It consists, altogether, as we see it, of a number of elements and battery cells, as they are called, 16 or 32, as the maker may decide. A galvanic current may be produced with a single cell, but for therapeutic or surgical purposes, a number of cells are required. But for illustration of this, as well as other batteries to be described, we take it for granted that one cell only is used. Fig. 3 represents this

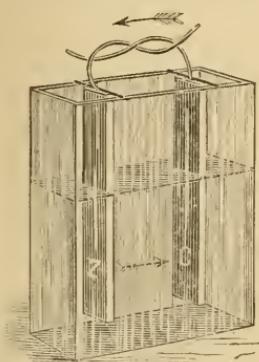


Fig. 3.

single cell, made of glass or hard rubber, as may be desired, with a capacity sufficient to hold about two fluid ounces. For further illustration we now fill this cell about two-thirds full of a battery fluid, made as follows: To five pints of cold water add eight fluid ounces of commercial sulphuric acid, and, when perfectly cool, add thereto eight ounces of finely pulverized bi-chromate of potash. When this is well dissolved, and before using, add one ounce of bi-sulphate of mercury.

Now, we put the required amount of this fluid in the cell. In this cell we also suspend one zinc and one carbon plate, as seen in illustration, Fig. 3. The zinc and carbon are called the elements of the battery; the solution, the battery or exciting fluid; and the container, the cell. The zinc is called the generating element; the carbon, the conductor. Right here allow us to remark that electricity, when generated, may be transmitted by conduction or operate through induction. Conduction is the transmission through intervening metals, called conductors. Some metals are good conductors—copper is good; platinum, poor. By induction we mean the operation of electricity through the intervening molecules of air. This principle will be fully explained when we reach the Faradic current.

In the galvanic battery the electricity is transmitted through conductors, and, as above stated, the carbon in the battery cell is the conducting element, and to complete the circuit we connect the zinc and carbon, outside of the fluid, by intervening wires, as seen in Fig. 3. Now, here is represented, in this single cell, the principle and construction of a galvanic battery. When the electrically op-

posed metals, zinc and carbon, are immersed in the battery fluid and united at their ends, either directly or by wires, chemical action immediately begins, and in proportion to the amount of zinc surface exposed to the exciting fluid will be the quantity of electricity generated. The zinc attracts the oxygen of the fluid, is rapidly oxidized, and gradually destroyed. The hydrogen of the fluid is appropriated in another direction. The result of this chemical action is a *mode of motion*, called a current of electricity. This current passes from the zinc or generating plate to the carbon or conducting plate in the fluid, and outside of the fluid from the carbon, through the intervening wires, to the zinc. Now, let us, while this current is running, separate the ends of the wires connecting the zinc and carbon. Let us hold the two separated ends of the wires, one in each hand, and this same *mode of motion*, or current of electricity, is passing through the body, from one hand to the other, entering at the hand holding the wire attached to the carbon, which, outside the fluid, is called the *positive pole*. The current leaves the body at the hand holding the wire attached to the zinc plate, which, outside the fluid is called the *negative pole*.

This illustrates the working of a single cell galvanic battery. But we frequently want more quantity of electricity than we can get from one cell of this size, and we more frequently require a more forcible current—a current of greater tension—than we can get from a single cell like this. Where the quantity of electricity is small, but more especially where the tension is low, the current passing slowly, but little change takes place in the tissues to which the electricity is applied, and the current is not felt or appreciated in any way. Where the tension is high, the current strong and running rapidly, then we observe redness of the skin, twitching of the muscles, and the patient complains of disagreeable sensations. In such a case the fluids of the tissues are rapidly separated, the acids and oxygen rushing to the positive pole of the battery, while the hydrogen and alkalies are attracted to the negative pole. A very small quantity of electricity may accomplish a great deal if the tension is high; but for the purposes of galvano-cauteries, quantity is positively required. How are we to increase tension, and how are we to get more quantity? As already stated, the quantity of electricity generated in a galvanic cell is dependent upon the amount of sur-

face exposed to the exciting fluid by the generating plate; and when it is required to increase the quantity, the elements must be enlarged, or the generating plates of several cells must be connected directly, and the carbons must also be directly connected. Where we want an increase of force, or desire to increase the rapidity of the current—in other words, when we want more tension—we connect alternately the generating and conducting elements, the zincs and the carbons, of two or more cells, as illustrated by Fig. 4, where the

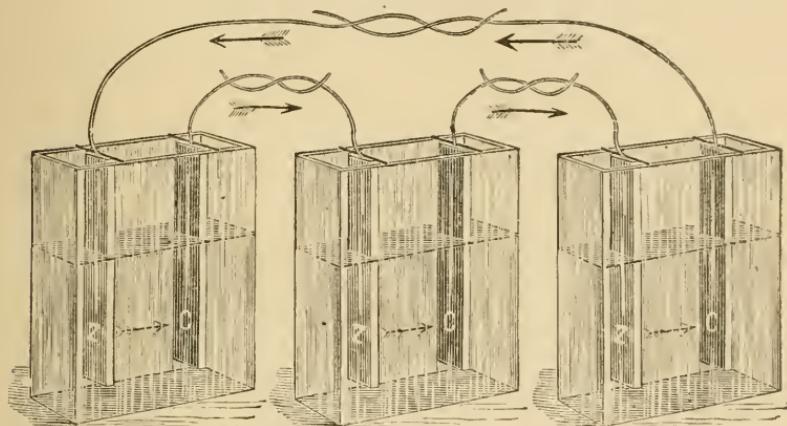


Fig. 4.

zincs and carbons are connected alternately, and the direction of the current plainly shown. Increasing the size of the elements always gives a proportionate increase of quantity, but it does not increase the tension or rapidity of the current. On the other hand, while a combination of two or more cells, as above described, the elements connected alternately, increases the tension in proportion to the number of cells thus connected, the quantity of electricity passing any one point at the same time is no more than when one cell is used. Enlarging the elements or directly connecting several generating plates, and in like manner as many conducting plates, increases quantity.

In the galvanic battery of Stohrer, used in this illustration, the combination of cells is for the purpose of increasing the tension, a property of the current particularly required in electrolysis. The instrument shown in the illustration has sixteen cells. Assuming

that they are all properly filled with fluid, and the elements suspended in them and alternately connected, as illustrated by Fig. 4, we may undertake to operate the battery. For the purpose of convenience in conducting the electricity from the battery to and through the body, we use cords, called conductors, constructed of copper wire and covered with silk. The covering is called the insulator, because it is a non-conductor. The ends of the cords have exposed metallic tips, for the purpose of connecting them at one end with the commutator of the instrument, and to the handles of the electrodes at the other ends. Remember, the commutator is that part of this instrument which we slide along the beam of wood at the top of the apparatus. This commutator is so arranged as to connect with a zinc on one side and a carbon on the other, and a complete circuit is made through one cell by placing it at the right. To take in more cells, we simply move the commutator to the left till any desired number of cells are taken into the circuit. The electrodes are the parts of the instrument attached to the distal ends of the conducting cords, and are directly applied to the part of the body desired to be brought under the influence of electricity. These electrodes are metallic, and may be covered with chamois or sponge. More will be said about electrodes as we approach therapeutics. Other particulars, as well as the advantages of this particular battery, are given in detail in the illustrated circulars sent with the instrument.

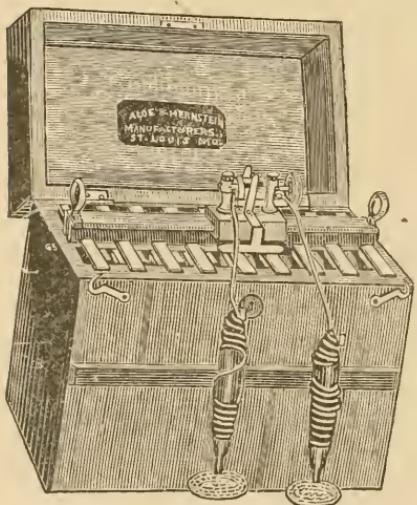


Fig. 5.

Another form of Stohrer's galvanic battery is represented below by Fig. 5. This is a very practical instrument, easy to operate and readily cleaned or repaired when necessary. Its arrangement is so simple that a mere novice may soon understand it, and any wrong in its workings can be detected at once. It is manufactured by Aloe & Hernstein, of St. Louis.

It is a sixteen-cell battery, with large elements, zinc and

carbon, the same as those made by the Galvano-Faрадic Manufacturing Company. Aloe & Hernstein are making fourteen-cell batteries similar to this, with still larger elements, giving more quantity and, they claim, more power.

The bottom of the box in these batteries is a movable tray in which the glass or hard rubber cells are placed. This movable tray is controlled by two hinged rods which are fastened to it, and these by two screw lifting rings. These rings, being screwed tightly down, hold the cells firmly against the cushioned board, which is pushed through a slot in the front of the

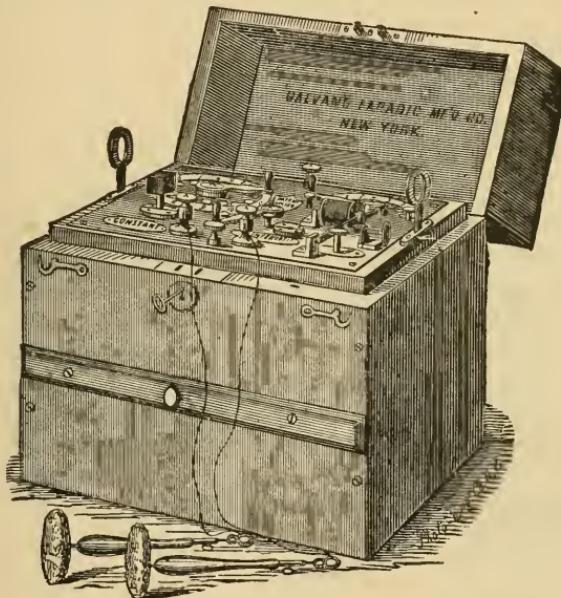


Fig. 6.

box, and covers the cells. This cushioned board is called the hydrostat, because it securely closes the cells and prevents spilling of the fluid in moving the battery from place to place. The rings referred to also serve as handles for lifting the tray of cells to which they are attached, and when raised to the proper place the rods are turned on their hinges and the tray of cells held in place, with the elements in them. When done using the battery, the rods are straightened, the tray of cells lowered, and the hydrostat, which

was removed before lifting the tray of cells, is now replaced, the screw-rings turned a few times, and all is secured.

The commutators, conductors, etc., are the same as in the first battery described. For all ordinary purposes, such as central galvanism, electrolysis, etc., these batteries are exceedingly well adapted.

Fig. 6 represents the Bartlett galvanic battery, manufactured by the Galvano-Faradic Manufacturing Co., of New York. This is a thirty-six-cell battery, the elements zinc and carbon all arranged in very compact and neat style. The tray holding the cells is controlled by lifting rods, the same as the Stohrer battery. The commutator works with a lever or crank, and from one to thirty-six cells may be brought into the circuit at pleasure. This is a fine appearing instrument, and being provided with an automatic rheotome, current reverser, etc., it is a very desirable battery.

The following cuts represent the galvanic and galvanic and

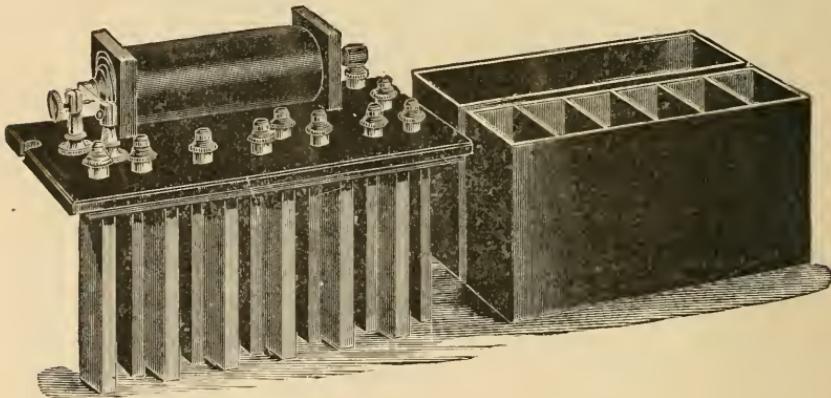


Fig. 7.

Fig. 8.

faradic batteries combined, as manufactured by the M'Intosh Galvanic Belt and Battery Company, of Chicago, Ill. These batteries are constructed on an improved plan. The elements are zinc and carbon, and are arranged in couples, and securely clamped to hard rubber plates with thumb-screws. Any of the couples can be removed by simply loosening a screw. In this battery the plates are brought very near together, thus preventing the great internal resistance unavoidable in many other batteries. The cells are made in sections of six, composed of one solid piece of hard rubber. By

this arrangement one section can be handled, emptied, and cleaned as easily and as quickly as one cell. A hard rubber drip-cup is placed by the side of each section of cells to receive the zinc and carbon plates when removed from the cells.

Fig. 7 shows the hard rubber plates of a section of elements. Fig. 8 shows a section of six cells made of one piece of hard rubber, and a drip-cup of the same material to receive the zinc and carbon couples when not in use.

The hard rubber on which the couples are clamped projects over on one side enough to cover the cells, when the zinc and carbon plates are reversed and placed in the drip-cups. The under side of this projection is covered with soft rubber. When the cells are not in

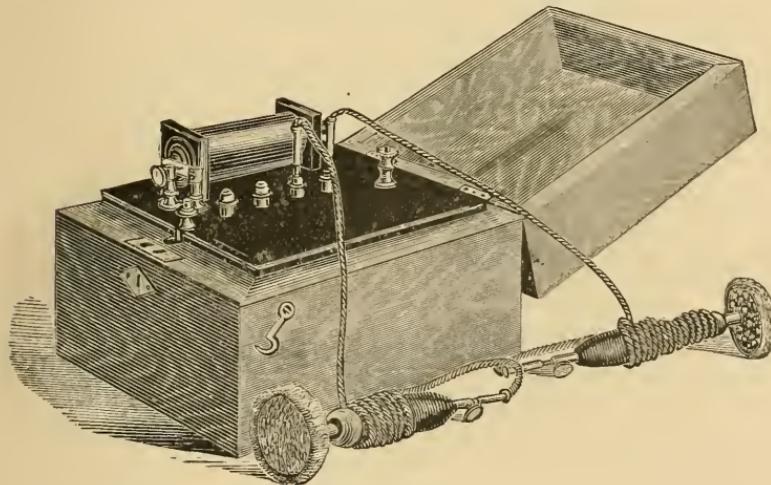


Fig. 9.

use, this is clamped over them by means of thumb-screws and spring bolts. By this arrangement the cells are made water-tight, and the battery may be carried from place to place without danger of spilling the fluid.

Fig. 9 represents a Faradic battery of this make, which we will refer to again when we reach the construction and workings of Faradic machines. In this illustration is shown the famous cable conducting cords used in these batteries. They are made with a spiral copper wire, insulated, inside of which is a bundle of small copper wires surrounding a strong cord. The tips are securely fas-

tened to the spiral wire, which makes the connection perfect. In using any of the M'Intosh batteries, these cords are attached to the posts on the battery, the distal ends being fastened to the electrodes. One of these conducting cords is bifurcated, or forked, either division of which may be attached to the battery. This forked end is for the purpose of preventing a shock while changing to a less or greater number of cells while using the galvanic current. For example: Suppose you are using six cells. One of the bifurcated ends would be connected with cell No. 6, and the other end hanging loose. If you wish to use, say, twelve cells, you can take up the loose end of the bifurcated cord and connect it with No. 12, and then pull the other end out from No. 6. Thus all

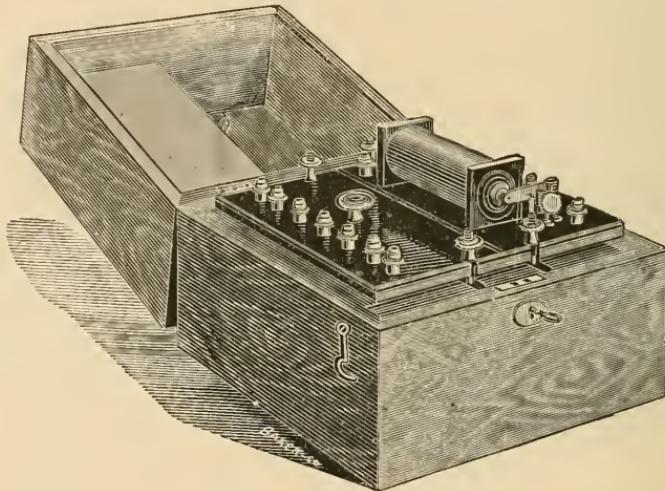


Fig. 10.

shock is avoided. This arrangement takes the place of the commutator which was referred to in the Stohrer and Bartlett batteries. This is a simple arrangement, and could not be more satisfactory in any way.

Fig. 10 shows a twelve-cell combined galvanic and faradic battery of the M'Intosh make. The case is polished black walnut, $8\frac{1}{2}$ inches long, 8 inches wide, $7\frac{1}{2}$ inches high, metal work all nickel-plated, lock and handle, sponge electrodes, and cable conducting cords, as above described, all put up in the very best of workmanship style.

Fig. 11 represents another form of a twelve-cell combined galvanic and faradic battery made by M'Intosh. This is a beautiful battery, too, same size and finish as Fig. 10. These are exceedingly fine instruments for a general practice. They are safely carried

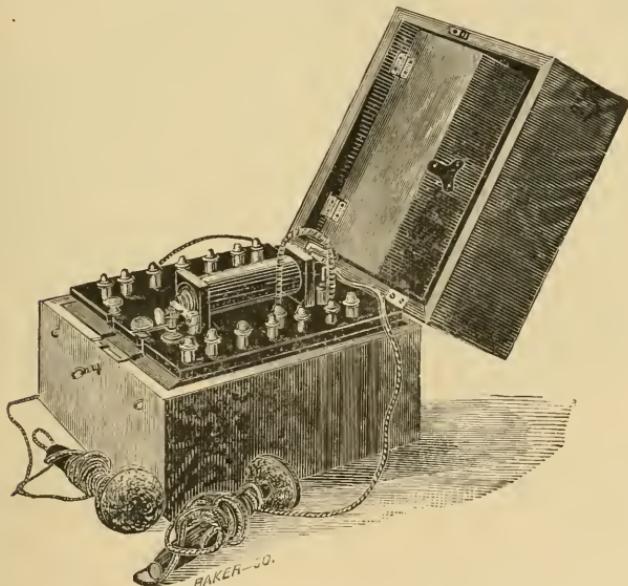


Fig. 11.

about, and you always have with you a faradic and galvanic battery at the same time.

Fig. 12 represents a twenty-four cell combined galvanic and faradic battery of the same manufacture. Size, 15 inches long, $8\frac{1}{2}$ inches wide, $7\frac{1}{2}$ inches high, with lock and handle; weighs less than eighteen pounds. This battery gives a galvanic current of great intensity, sufficient to treat almost any case coming in the range of a physician's practice. And the beauty of this instrument is, we can reverse one section of elements at a time when no more is needed, thus saving the elements of all other sections for future use. But where one section does not give us sufficient intensity, we reverse another section, lifting it out of the drip-cup and placing it in the battery fluid in the cells. This arrangement is certainly a commendable feature.

Special instructions, well illustrated, are sent out with all these instruments, so that a mere novice can operate them without a

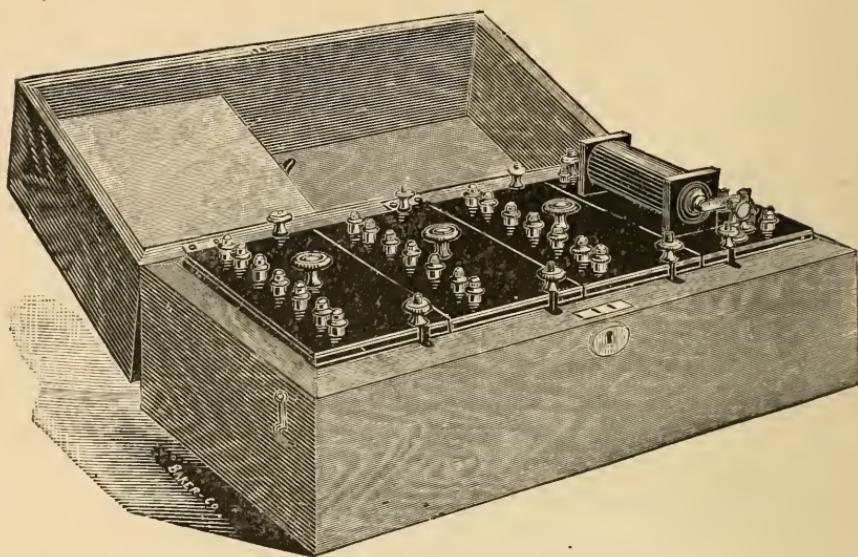


Fig. 12.

teacher. We have used these galvanic batteries and know them to be what they are represented to be—simple, efficient, and practical in every regard. When we reach therapeutics, these different instruments will be referred to again, and careful instructions regarding their use will be clearly set forth.

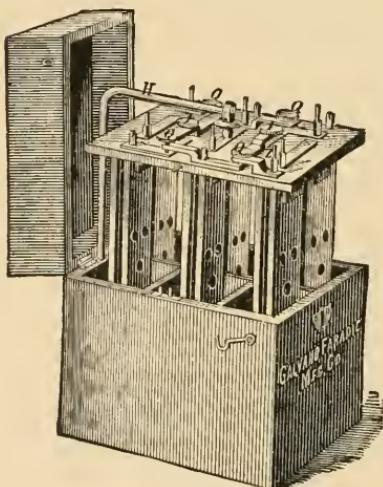


Fig. 13.

Fig. 13 represents the Piffard galvano-cautery, as made by the Galvano-Faradic Manufacturing Company, of New York. For the purpose of cauterizing, galvanic batteries are constructed with reference to quantity. The elements are zinc and carbon, and the battery fluid the same as in ordinary galvanic batteries described in the first part of this monograph. This battery of the Piffard style is composed of large zinc-carbon elements, which are contained in cells of vulcanite, and can be suspended on a mov-

able arm screwed into the box. When lowered into the fluid, the top of the elements, which is made of hard rubber, contains two lateral bars supporting them, and which permits of a rocking motion to keep this exciting fluid agitated. This is a very efficient galvano-caustic battery, a complete and reliable instrument, powerful, portable, compact, and so free from complications and easy of management that any physician can understand it and operate with it. It is adapted to meet all cases usually treated with this class of instruments. In its construction each element is utilized to the fullest extent. The parts can be easily replaced, and the surgeon living at a distance can duplicate them and adjust them without difficulty. Size, 9 inches long, $6\frac{1}{2}$ inches wide, and 10 inches high. Weight, 15 pounds.

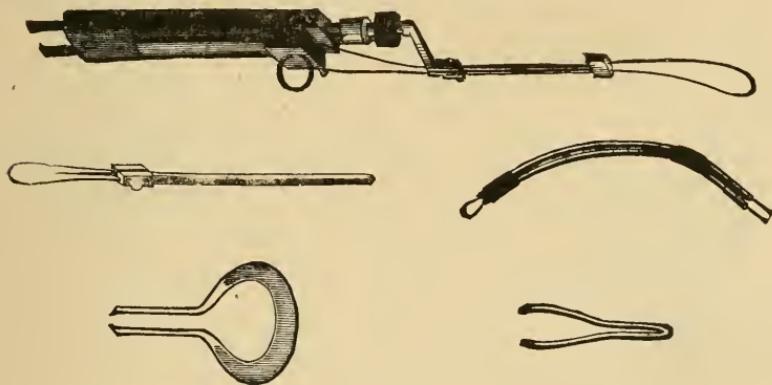


Fig. 14.

These cuts (Fig. 14) represent the instruments used in galvano-caustic operations. Universal handle; handle for cutting loop when one hand only is at liberty; burners of various shapes.

The use and application of this battery will be fully explained and clearly illustrated later in the work.

So far as a description of galvanic batteries is concerned, we think we have shown a sufficient variety, and with what may be said about them incidentally in using them upon different patients and in different cases, we think the reader should finally have a very good understanding of them. Faradic machines will next engage our attention.

FARADIC MACHINES.

The chief object sought in the construction of faradic machines, is to obtain a current of electricity or mode of motion that will excite nervous and muscular functions. The simple galvanic current excites these functions to a limited degree, but its great merits depend more upon the changes wrought in the structures, fluids and solids of the parts by the passing galvanic current. The faradic current influences, mainly, the nervous system. The galvanic current produces a change in all the tissues, but its direct influence upon the nervous system is comparatively limited; but, indirectly, wonderful changes in the nervous system frequently result from the use of galvanism. All this will engage our attention further on. What we particularly desire to place before the reader now is this: The faradic current or the current coming from electro-magnetic machines, is the great nerve stimulant and tonic: under its influence upon the nervous system the processes of waste and repair are increased, nutrition is improved; "the strengthened brain sends more nervous force to the stomach, by which the latter is enabled to send better blood to the brain."

The galvanic current is a direct and continuous current, as fully described in the foregoing pages. The faradic current is an indirect or *induced* current; and it is an interrupted current. The electricity producing the faradic current is the same as that of the galvanic current, and may come from the same battery, but through intervening machinery the current or mode of motion is greatly modified before it reaches the patient. In the production of a galvanic current we may use a single cell, or we may unite the force and influence of many cells, which we find positively necessary in the successful use of galvanism. We may use two or more cells, with the faradic current, but one cell with the proper elements and exciting fluid, is generally quite enough for all practical purposes, and nearly all the faradic machines in the market are constructed with one cell. The elements may be zinc and carbon, and the exciting fluid the same as that used in the galvanic batteries heretofore described. Or the elements may be zinc and platinum, and the exciting fluid dilute sulphuric acid.

These are called Smee's elements. Or the elements may be zinc and carbon, and an exciting fluid produced by the use of bi-sulphate of mercury and water. Gaiffe's celebrated French pocket batteries are of this construction. The following illustrations will serve to give the reader a very good idea of the battery cells and elements referred to:

Fig. 15. Shows a battery cell where zinc and carbon are used as elements, and a solution of bichromate of potash, and sulphuric acid as the exciting fluid.

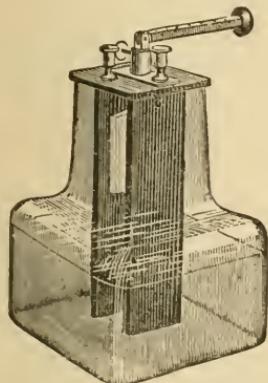


Fig. 15.

In principle this is the same as the cells of all zinc and carbon galvanic batteries; the only difference is in the shape of the single cell, which is so constructed as to adapt it to the accompanying machinery.

Fig. 16. Represents the Smee battery cell the elements being zinc and platinum, and the exciting fluid sulphuric acid and water—one part acid to ten of water.

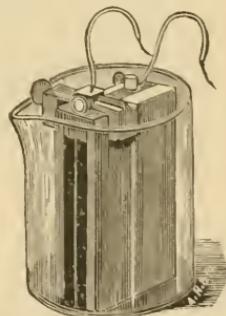


Fig. 16.

The physician's improved electro-magnetic machine, manufactured by Aloe & Hernstein, of St. Louis, is operated by this cell. And the famous electro-magnetic machines of Kidder are constructed with this cell, only the shape of the cell, and management of the elements differ a little.

Fig. 17. Shows Smee's elements and cell as manufactured by Kidder. The elements are suspended from rubber stopper in round jar, $3\frac{1}{2}$ inches in diameter. In all these batteries, the zinc-carbon and zinc-platinum, the elements have to be removed from the fluid when the instruments are not in use, else the fluid would destroy the zines. In the zinc-carbon cell the elements are raised by a hinged rod which is turned down when the elements are raised out of the fluid. In the

cell containing Smee's elements, a drip cup is provided, and the elements lifted out of the fluid and placed in the drip cup when the instrument is not in use.



Fig. 17.



Fig. 18

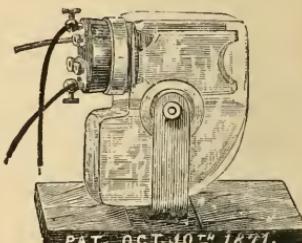


Fig. 19.

Figs. 18 and 19 show Kidder's improvement upon this plan. He has constructed a cell that when turned right end up keeps the elements immersed in the exciting fluid; when it becomes necessary to stop the action of the instrument, a simple tip describing a quarter circle elevates the elements and lowers the fluid so that they are entirely separated.

This is a great convenience, and all of Kidder's tip batteries, as he calls them, are furnished with this cell.

Zinc and carbon elements with an exciting fluid made of bisulphide of mercury and water are used with various pocket electro-magnetic machines in the market, and will be referred to under the description of these instruments.

So far as cells, elements and exciting fluids are concerned the above should be quite sufficient, and we now introduce a variety of electro-magnetic machines complete.

Fig. 20. Represents a fine instrument of this class, manufac-

tured by the Galvano-Faradic Manufacturing Co., of New York. The elements are zinc and carbon, suspended by hinged rod, as heretofore described.



Fig. 20.

evolution of electricity; that the carbon in the cell attracts and conducts this electricity out of the fluid as it is generated; that if a wire is attached to the upper end of the carbon outside of the fluid, and connected with another wire attached to the upper end of the zinc outside of the fluid, we have a simple galvanic current—a continuous direct current.

Now in the construction of a machine to produce a faradic or induced current, instead of attaching a short wire to the carbon, a longer wire is used, ten to twenty feet. This is insulated and wound upon a hollow spool, or bobbin, one round upon another. Then a still longer and smaller wire, perfectly insulated, is loosely wound upon this bobbin, and when all wound up we call this the faradic coil, or helix of the machine. The rounds of wire composing this helix or coil are parallel with each other. Now, if the current in the first wire is broken, a current is generated in

The introduction of this instrument calls for a description of the machinery placed in the circuit of the galvanic current, which converts it into a faradic current. And now, let us keep in mind that we have before us a single cell, like that in the galvanic batteries already described; that the battery fluid coming in contact with the zinc excites chemical action, which results in the

the second wire by induction, the electricity passing through the intervening molecules of air. If the current in the first wire is again closed or caused to flow, another current is generated in the second wire, by induction, but in an opposite direction; hence the current in the second wire, which is an induced current, is not a continuous current, but a succession of currents, resulting from breaking and opening the main current. And this induced current is a to and fro current. For the purpose of breaking the main current, and producing the induced current, the wire conducting the current from the battery cell is so connected with an automatic hammer that the current is rapidly broken and renewed, which results in a rapid succession of to and fro currents in the second wire. The spool upon which the coils of wire are wound is hollow, and in this a bundle of soft iron wires, each carefully insulated is placed. The currents flowing through the wires surrounding this bundle of iron wires magnetize this bundle, and, while thus magnetized it reacts upon the coil and greatly strengthens the current in the wire. In this way the faradic coil is greatly dependent upon magnetism for its force. Being wonderfully strengthened by the bundle of wires that become magnetic under the influence of the galvanic current, we say *electro-magnetic* when speaking of these instruments.

From the above it will be seen that the simple galvanic current, in passing through different coils of wire parallel with each other, strengthened by a magnetic core, and rapidly broken, causing to and fro currents, must be greatly modified when it reaches the patient; and so it is. While the to and fro character of these currents destroys, almost entirely, the electrolic force of the currents, the power of exciting the nervous system and producing muscular contraction is wonderfully increased; and this is further strengthened by the magnetic influence of the core or bundle of iron wires in the helix.

Fig. 21. Represents the Physician's improved electro-magnetic machine, as manufactured by Aloe & Hernstein, of St. Louis. It has two cells, (acting independent); in case one gets broken or exhausted, the other is in reserve; the two cells can be united when extra power is required, as in case of suspended animation. It has a three section coil, and is therefore well adapted for the

medical profession, as a tension and quantity can be obtained, which are very essential for the electric treatment. When the

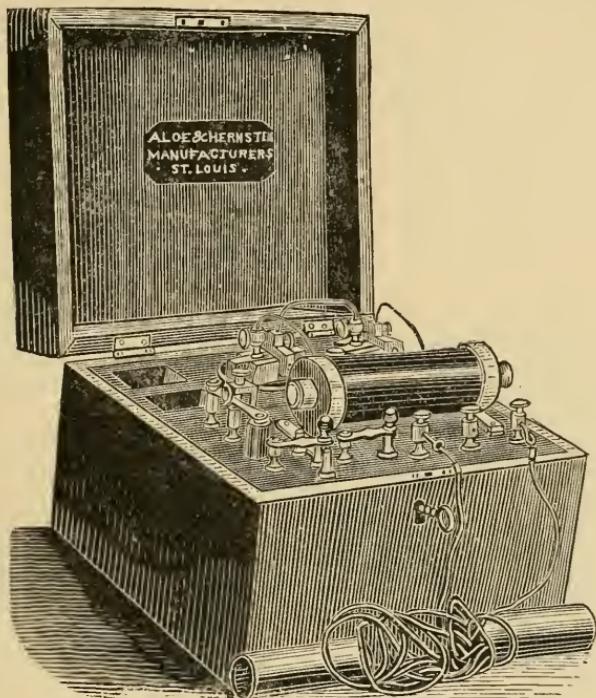


Fig. 21.

pole cords are connected to Post 1 and 2, and the switch is turned on the No. 1 Switch Post, a mild current without quantity is obtained. By placing the switch on the next post, (or No. 2), the current is stronger and some quantity is obtained. By placing the switch on the next or last post No. 3), a powerful current which contains quantity and tension combined is perceptible. Remove the switch entirely from all of the posts, place the pole cord which is in No. 1 into No. 3 post, and you will obtain a strict primary current. This battery is perfectly portable, as the elements are removed and placed in separate cups, while the cells which hold the fluid are each closed with a well fitting rubber stopper. Switch 4 is for breaking the current by removing it from the post on which it rests; it stops the working of the

battery. The helix, or coil, which is one of the main parts that constitute an electric machine, should be well guarded against dampness or impure atmosphere; we have therefore taken the precaution in this battery (so that nothing of the kind can happen) to place a hard rubber jacket over the helix, which is the best insulator that can be had. **COMPLETE WITH SPONGE HANDLE ELECTRODES, BATTERY NICKEL-PLATED.**

Fig. 22. Represents Kidder's No. 1, Physician's office electro-medical apparatus, large size having four coils of wire in the helix, and ten currents.

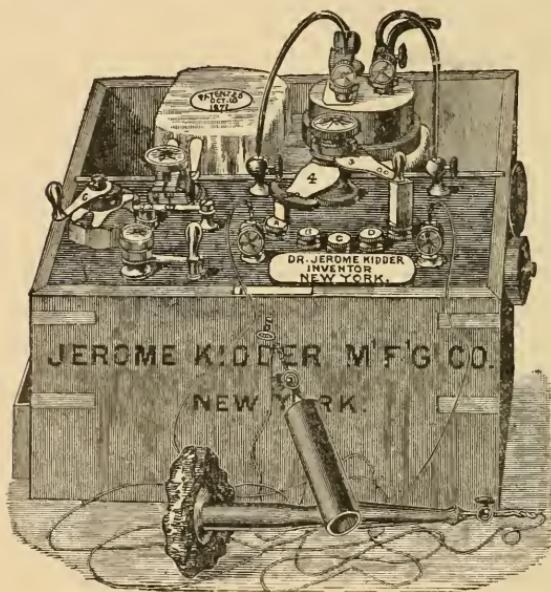


Fig. 22.

of quantity and intensity, when used in combination with all the other coils as will go *beyond* the range of the greatest effect on the muscles, and *into* the range of soothing electricity, and with mild power, it will exercise the function of vision showing glimmering light, without producing pain. The power of these currents is increased or diminished at pleasure. Full directions for use accompany the instrument.

Fig. 23. Represents a four coil apparatus of Kidder's make, and intended for a physician's visiting machine. It produces ten

There is sometimes a demand for a large range of effect, and to meet this Dr. Kidder has furnished a four coil helix, developing ten currents from the different combinations produced by ranging the two posts selected for the positive and negative. The fourth coil is conditioned to produce electricity in such a ratio

currents, the same as No. 1. It is of compact form, constantly ready for use many weeks without attention.

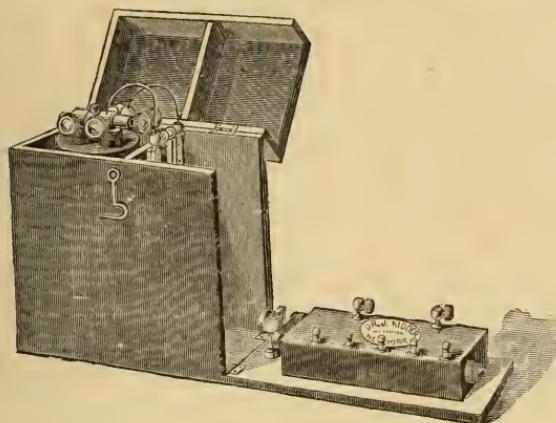


Fig. 23.

horizontal position, as seen in the figure. If ever desired, the coil-box can be detached and connected with any other battery by the two screw cups on the back part. This machine is about 6 inches long, $3\frac{1}{2}$ wide, and six inches deep, and has a metallic handle on the lid for carrying.

Fig. 24. Shows Gaiffe's Pocket Electro-Medical Apparatus. This is a fine machine, and is very popular with all electricians.

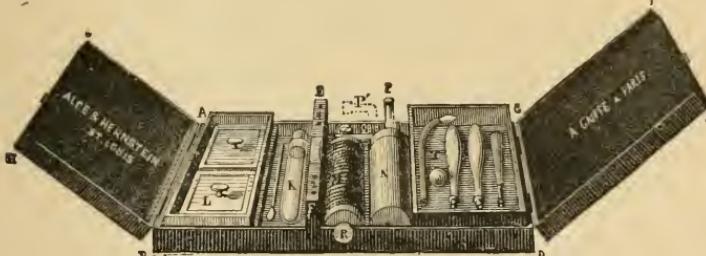


Fig. 24.

This battery is put in motion by putting a half a teaspoonful of bi-sulphate of mercury in each of the carbon vats or trays, and adding a little water, then immersing in the vats the zincs belonging to the battery.

This battery runs, without being recharged, during a sitting of

The coil-box stands upright in one end of the case where it is hinged. By springs underneath the hinges that fasten the coil-box to the case, the battery is connected to operate the coils when turned down to a horizontal position.

an hour, or for two sittings of a half hour, and gives three currents. 1st, The extra current. 2d, The inductive current. 3d, A combination of the two, in greater intensity. Though the results of these currents may be the same physiologically, yet they present a series of increasing effects which may be varied at will, beginning with a current so mild as scarcely to be perceptible, and being gradually increased to one of great intensity. When the battery is charged with the bi-sulphate of mercury and water, it gives rise to no odor. All its parts are perfectly adjusted, and do not readily get out of order. Extra troughs may be obtained at a small cost, thus enabling the physician to leave one with each patient whom he treats by electricity. This arrangement also diminishes the weight of the apparatus. The whole machine is in form of a case, $7\frac{1}{2}$ inches long, 4 inches wide and $1\frac{1}{2}$ inches thick, weighing only 24 ounces, including therein the electrodes, etc., contained in the case. Nothing protrudes from the exterior. It is, in fact, a pocket instrument, combining with compactness and durability all the qualities of superior electro-medical apparatuses.

Fig. 25. Represents Kidder's pocket induction apparatus, which he claims to be superior to anything of the kind.

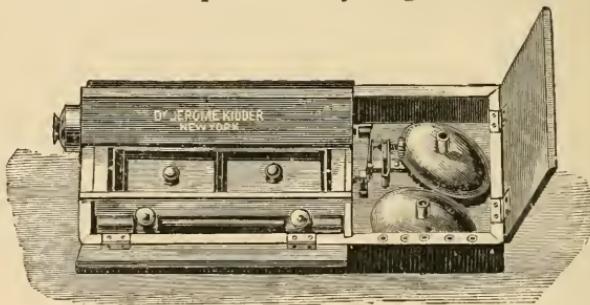


Fig. 25.

This apparatus has very expensive coils so as to get the desired ranges in the qualities of currents, in a very small space. It operates by means of a very little bi-sulphate of mercury, gives very strong power, and is very satisfactory in its operation. Two handles and sponge-clasps with conducting cords accompany each apparatus.

Fig. 26. Represents Dr. Hathaway's Electro-Magnetic Chair.

The object of this invention is to provide a simple and convenient apparatus for the transmission of electrical currents through all parts of the human body and in different directions. It consists of a chair (or a bed, lounge or water bath may be used) provided with a suitable battery, wires and switches, by means of which currents of electricity may be passed through the body of the patient sitting therein, such currents being under the absolute control of the attendant, who can send them at will, first in one direction, and then in another, as desired.



Fig. 26.

The special application of this powerful remedial agent to any particular portions of the person has, thus far, been attended with great inconvenience. So far as known to me, it has never been done without the removal of the patient's clothing, and the passing of the current by means of a sponge or like substance over the surface of the body.

In using this apparatus, it is only necessary that the hands

and feet should be bared. The patient sits comfortably in a chair, and when the switches are placed in a proper position, the current is made to enter the right foot, pass up the right leg, cross through the pelvis into the left leg, and down out of the body by the left foot. If now the switches be changed, the positive current enters the left foot, makes the circuit, and goes out of the right. In this way I am enabled to pass the electricity through the pelvic portions of the body, which heretofore it has been almost impossible to reach.

In a similar manner, the proper connections being made, the currents will enter the body by either hand, pass up the arm, cross the thorax to the other arm, and leave by the opposite hand. The switches may also be placed so that the electricity will enter both hands, pass through the entire system, and out by both feet.

The management of this apparatus is easily learned, and as the changes are made at intervals of five minutes, one attendant can, without difficulty, attend to four chairs at the same time.

I know this to be a convenient invention for the administration of this powerful therapeutic agent without giving the patient any trouble whatever. When in Chicago, at the National Convention, I took the pains to call at Dr. Hathaway's office, and examine this Chair, as he had it in operation. I wanted one immediately, for it is so convenient. Many people are benefited by electricity, but the use of it, as ordinarily applied, requires so much time and care that the busy practitioner can hardly afford to appropriate it. But this invention does away with the objections. It is easily managed, pleasant to the patient, and in many cases where electro-magnetism is required, it is THE thing. I am greatly pleased with it, and will freely give any information I can in regard to it; or I will take pleasure in showing the chair to anybody who may take the trouble to call at my office where it may be seen in operation.

Of course we do not pretend that everything in the way of faradization can be done through this chair, for we sometimes desire to localize the faradic current, and where this is the case we resort to a Sponge electrode. But in the scores of cases of nervous exhaustion that come to us, where general faradization is the therapeutic agent, then this chair is a real luxury. I would not be without it and engage to treat diseases of the nervous system.

Having described and illustrated a variety of galvanic batteries and faradic machines, we now present some important attachments used in connection with galvanic batteries for special and important purposes.

Galvanometers, or Galvanoscopes.—These are instruments used for ascertaining the presence and direction of a current, and for measuring the strength of the same. They are constructed on this principle: A magnet is freely hung so as to be deflected by the passage of a current through a coil of insulated wire.

Fig. 27 is an illustration of a very fine galvanoscope. It may be readily attached to any battery; and if a current is running, the needle will be deflected in the direction of the current. If the needle turns to the left, we know the negative pole is on that side; if to the right, then we know the negative pole is to the right.

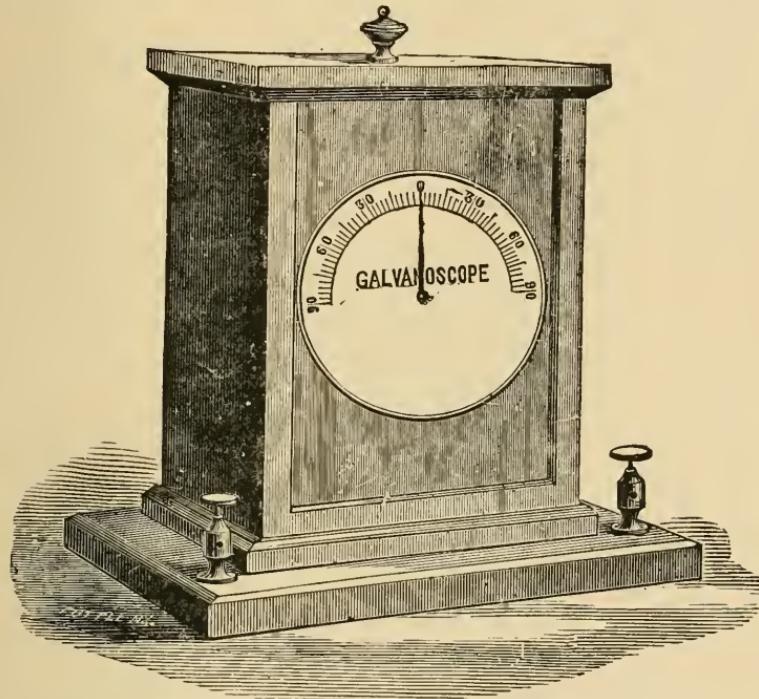


Fig. 27.

The number of degrees of deflection shown by the needle indicates the strength of the current. In this way, we can know exactly what we are doing; know the direction of the current, its strength, etc.; and this is very important in many cases of galvano-therapeutics. Other varieties of galvanoscopes are made, and in use, but this is a good one, and easily managed by anybody who can operate a battery. To use it, we simply attach the conducting cords of the battery to the posts of the galvanoscope, and the electric current is closed.

Rheotomes.—A rheotome is a contrivance for interrupting the electric current. Without something of this kind we could not have an induced current, for this is only present in the secondary coil, at the opening and closing of the primary current. By means of the rheotome, the primary current is broken and closed rapidly, so that the induced current seems almost like a continuous one. We also use the rheotome on galvanic batteries. By interrupting the galvanic current, we can frequently excite muscular contraction more perfectly and powerfully than can be done by applying the faradic current. But the interrupted galvanic current is not like the induced faradic current—a to-and-fro current—but a succession of straightforward currents.

Fig. 28 is an illustration of Powell's rheotome. These in-

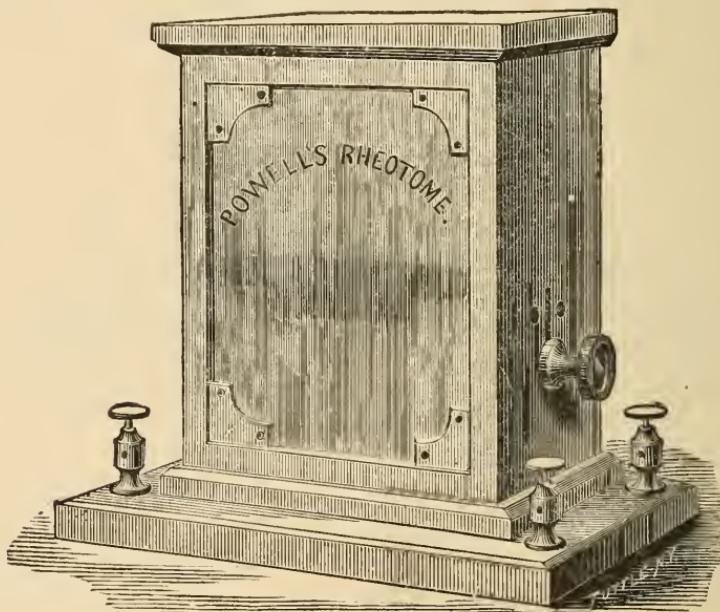


Fig. 28.

struments—any of them in the market—may be attached to any battery; and some galvanic batteries are provided with them as permanent attachments. See the illustration of Bartlett's galvanic battery, and it will be observed that the rheotome is per-

manently fixed on it. Their use is very simple. In all faradic machines, they are essentially a part of the instrument, and run whenever the battery is put in motion. In galvanic batteries, they have to be properly connected, placed in the circuit of the current every time we use the battery. This is readily done; and all batteries are accompanied with specific instructions regarding the manner of operating them and applying the attachments.

Rheostats.—Rheostats are used for the purpose of modifying the current of electricity. They are placed in the circuit of the current, in the course of the conducting wire leading from the carbon of the battery to the patient, in the positive pole, while the negative pole of the battery is continuous, nothing intervening between the battery and the patient but the negative pole of the battery.

Fig. 29 is a form of rheostat called a hydro-rheostat.

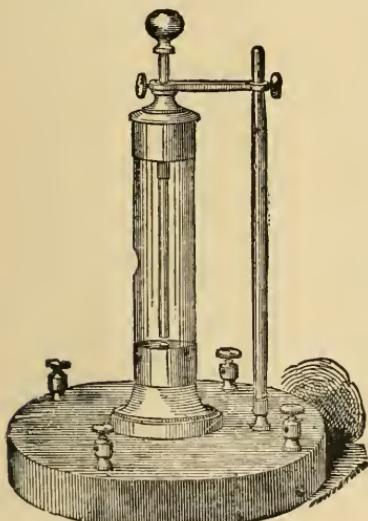


Fig. 29.

This is a very reliable rheostat, and is easily managed. The glass tube seen in this illustration is filled with water, and the construction is such that the current may be made to pass through the water in this tube from bottom to top, or but a limited portion of it may be traversed by the current. In this way we may greatly soften the current and produce exceedingly delicate shades or grades of sensation. Other forms of rheostats are used; but this is as good as any, and is so easily managed.

The general practitioner may not see the necessity of such instruments as these; but when we

have nervous diseases of all varieties to handle, and sensitive organs like the eye, ear and brain to treat, it sometimes becomes positively necessary to resort to rheostats before we can employ

electricity at all. While rheotomes are used to increase the exciting power of the current, which is sometimes necessary, rheostats are used to soften the current, or produce delicate grades of sensation. This will be referred to again, when we reach therapeutics.

ELECTRO-THERAPEUTICS.

Electricity is simply a force, and like all other therapeutic measures, must be rightly applied if we expect to accomplish much good with it. To be sure, a mere novice may relieve and cure people with electricity, knowing but little about what he is doing. But this is accidental, and such ignorant practitioners are liable to do as much harm as good. Before we undertake to apply this potent agent to the cure of disease, we should study its physiological effects, that we may be able to use it as we would any other therapeutic agent, for a direct and definite purpose. It is not sufficient for us to say our patient is nervous, and that electricity is a remedy for nervousness. No, this is not a satisfactory conclusion to rest and practice upon. We want to know *how* our patient is nervous. Is the nervous system, or that part of the nervous system supplying the diseased organs in a state of hyperæsthetic excitement, accompanied with pain? or is there a high state of irritability, giving rise to physical and mental distress, dependent upon exhaustion or mal-nutrition? or is there a semi-paralytic condition, with diminished sensibility and loss of muscular motion? The condition of our patient must first be understood, then we may turn to our batteries for a possible remedy. Well, what may we expect from batteries? Our answer is this: It has been found that electricity may be employed in medicine and surgery for the accomplishment of various ends. While its general effect is largely manifested upon the nervous system, its sphere of action is not limited to the nervous system alone. For its local effects, or for a general influence, electricity may be applied so as to act as a stimulant, a tonic, and as a sedative. Indeed, these three properties—stimulant, tonic and sedative are appropriately given to this agent. These

properties, singly or in combination, are secured only by and through the proper manipulation of the instruments used in generating and conducting electricity to the body. For example: if we desire to stimulate any part of the nervous system, we may apply the negative pole of an electro-magnetic machine directly to that part. The negative pole of the induced current is a powerful stimulant, exciting muscular contractions, increasing sensibility, and when frequently applied for several minutes at a sitting, nutrition is improved, and lasting tonic effects result; the parts are invigorated. Again: if it be desirable to produce sedation, or quiet nervous excitement in a part, or relieve nervous irritability in weak and feeble people, we apply the *positive* pole of the faradic machine to the diseased, excited or irritable parts. Where there is great excitement a mild current applied with a large sponge electrode, attached to the positive pole, will give the desired results at once. Where there is more exhaustion, yet unnatural nervous irritability, a stronger current, through the positive pole, should be used, and soothing effects will result, while the parts are at the same time greatly invigorated.

When the faradic or induced current is applied to any particular part of the body, *local faradization* is the term used in expressing the measure employed. Where the whole body is brought under the influence of the induced current, *general faradization* is the term used to express it. As above instanced, local faradization may be had resort to where we desire to apply a direct stimulant; in which case, we apply the negative pole to the diseased part, and allow the patient to hold the electrode attached to the positive pole in the hand; or the positive pole may be placed over the course of a nerve, or over the site of its origin, while the negative pole is applied to the part to be stimulated. On the other hand, when a soothing, sedative influence is sought, we apply the electrode of the positive pole to the part, while the negative is held in the hand, or placed upon some unimportant part of the body. This is all local faradization, so called. Of course the current is not positively confined to the diseased parts, neither can it be. We may, however, by placing the electrodes of the positive and negative poles near each other on the body, confine the action to a comparatively small spot.

The following examples may serve to illustrate local faradization, and local galvanization, and their uses: Mrs. K., about thirty-five years of age, married, and otherwise healthy, comes to me complaining of a partial loss of sensation, and a total loss of motion in the left side of the face. She is suffering from what we call facial paralysis, or Bell's palsy. She cannot close the left eye, in consequence of which she suffers from smarting sensations in it, and it looks red, while tears drop from the lower lid. She cannot purse up the mouth as in health, and saliva continually drips from the left side, greatly to her annoyance. No particular pain is suffered, but the inability to close the eye, or control the flow of saliva, with the distorted appearance of the countenance, together with fears of a worse and probable permanent indisposition, excite great apprehension, and lead her to seek counsel, and obtain relief if possible.

The first question coming to my mind is this: I know that facial paralysis may be of a central origin, or it may be peripheral; that is, the nerve supplying the face may be diseased at or near its origin, in which case we say the disease is intra-cranial; or, it may be an impairment of that part of the nerve outside of the skull, in which case we say it is peripheral paralysis. To which class does our case belong? Our decision or diagnosis in the case is of great importance; for, if the disease is of a central origin, the prognosis must be guarded, but if it is simply a peripheral paralysis, the prognosis is favorable, and a positive and permanent cure may be promised.

This is not our first case, no, indeed; and from the experience and observation we have had we have learned to make successful and satisfactory examinations in this class of diseases. Well, how are we to know whether this is a case of central or peripheral disease? First, there is no mental aberration, neither is there any signs of hemiplegia; no sign of any paralysis except of the facial nerve, whereas, in cases of central origin, there are very apt to be signs of paralysis or weakness in other parts of the nervous system. But one of the most important and certain tests for central, or peripheral paralysis, is electricity; and I resorted to it in the case of Mrs. K. I have Kidder's electro-magnetic machine,

and I tip the cup holding the fluid, attach the cords, upon the distal ends of which I attach sponge electrodes, wet with warm water. I place the electrode of the positive pole on the side of the face immediately in front of the ear, and apply the negative to the cheek, and move it about over the face. I commence with a mild current; but as no muscular contraction results, I increase the strength by withdrawing the cylinder at the side of the machine; but still there is no muscular contraction. The muscles do not respond to the action of the faradic current; and this is one of the best evidences we have that the case is one of peripheral origin, for if it was of central origin the response would be prompt, but little different from health. I am pretty well satisfied. But I have a galvanic battery on my table, with a rheotome or current interrupter attached, and I change the cords and electrodes from the electro-magnetic machine to this, turning on twenty-four cells, and connecting the rheotome. I now place the electrode of the positive pole immediately in front of the ear, as in the case of the faradic current, and place the negative electrode on the cheek, between the ear and the mouth, and as I move it about over the cheek I observe a drawing of the face. The left corner of the mouth moves toward the ear, and as I move the sponge toward the temple, the eye closes. All this convinces me that we have a case of simple peripheral paralysis, and we so announce it, and commence treatment at once. While we value electricity highly as a therapeutic agent, it will be seen from the above that it is a valuable resort in the diagnosis of nervous diseases. This may be fully and clearly established in the examination of various cases.

Having made out our diagnosis, we next proceed to the treatment. In this case, local faradization is of but little use at first; at least, the improvement will be slow and the cure tedious if it be the sole dependence. But the interrupted galvanic current which takes a deeper effect than the faradic current, will, from the very first, improve the condition of the patient; and with the addition of small doses of strychnia, $\frac{1}{32}$ of a grain three times daily, a speedy cure may be expected, as was really the result in the case of Mrs. K. In such cases, the galvanic battery should be used

daily, at first, then every two or three days, each sitting occupying from ten to fifteen minutes. As the case progresses, it will be found that the muscles will readily respond and contract under the influence of the faradic current, when it may be substituted for the galvanic: in fact, it is better now than the galvanic current.

The above tests and treatment involve both local faradization and local galvanization; and it should be observed that while the faradic current is a powerful stimulant, there are conditions where the interrupted galvanic current has more influence in producing muscular contraction than the faradic current.

About the middle of September, 1881, Mrs. A., about thirty years of age, and married, applied to me, complaining of a lameness in the right hip, and a numbness of the right arm. I diagnosed the case as one of a rheumatic nature, and prescribed accordingly. On the fifth of October following, she came to me again, and upon careful inquiry and examination, I gained a correct history of the case, and found her in the following condition: The remedies prescribed for the supposed rheumatic trouble had done her no good; she had not been sick, neither had she been exactly well. A few days previous to her calling upon me, she had been attending the Fair, and while on the ground she experienced a peculiar sensation in the right side of the neck, as she expressed it. Upon examination, I found the location to which she referred as being the spot where the peculiar sensation was felt, to be just back of the petrous portion of the temporal bone, and extending to the foramen magnum. This was as nearly as she could point to the location. She said the sensation was likened unto the report of a pistol, and was immediately followed by a peculiar numbness on the left side of the face, and an inability to close the left eye, or draw up the left side of the mouth. As she gave me this history I observed that her speech was somewhat impaired, and that she did not wink the left eye. She also walked lame; could not handle her right leg and arm as well as she could the left. She was evidently suffering from a facial paralysis, and threatened with hemiplegia. She suffered from no pain; there was no tenderness under pressure anywhere along the spine, or about the base of the brain. Her

appetite was good, bowels regular, sleep undisturbed and refreshing.

Now, this is another case of facial paralysis. The same question, is it peripheral, or is it of a central origin, presents itself. As hinted in the history of our first case, the accompanying symptoms of weakness in the other parts of the nervous system, especially the evidence of hemiplegia, lead us to suspect that this is a case of central origin. But we resort to electricity again. We apply the faradic current to the cheek, and we observe that the muscles contract readily under its influence. As we move the electrode toward the eye the lid comes down, and the eye is closed. Here is another case where electricity aids us in confirming our diagnosis. But what can we do for the case, is the question. We know we have a serious case. We are guarded in our prognosis, and only promise to do what we can. We resort to local faradization, as in our first case. We give our patient strychnia and iodide of potassium, with other remedies having a tendency to counteract any rheumatic influence that may be present. We resort to local galvanization, alternated with local faradization. We use counter irritation over the right side of the cerebellum, and along the cervical portion of the spine. In the use of the electricity we always applied the negative pole to the cheek, and the positive over the petrous portion of the temporal bone, and over the cerebellum. Mild currents only could be borne. We treated this patient about six weeks without any improvement. But, upon the whole, she grew no worse. She got discouraged and went to another physician, and I have not learned the result.

We report this case to show the value of electricity in confirming our diagnosis and helping us to announce a correct prognosis. It also proves, to some extent, the comparative uselessness of electricity in the treatment of some cases.

Early in the spring of 1881, Mrs. G., a married lady, about twenty-five years of age, called upon me for what she called a swelling and stiffness of the right side of the face. Upon examination, I found it to be a case of facial paralysis. The face was not swollen, as she thought, but the paralyzed condition of it

made it appear so, and gave the feeling of stiffness. No other nervous symptom was apparent. The faradic current produced but little impression upon it; but under the influence of local galvanization and the use of strychnia and phosphorous, she recovered completely in about two weeks.

In the early part of the year 1879, a young lady, about eighteen years of age, was suddenly stricken with facial paralysis. It came on in the night, she knowing nothing about its approach. When she got up in the morning she discovered her distorted countenance; and, although she suffered from no bad or painful feelings, she was apprehensive. It was not so that I could treat the case at the time as seemed to be required, so she applied to another physician. He resorted to the faradic current—nothing else; and for several weeks she remained about the same thing—no better. Finally, however, she began to improve, and made a complete recovery; but the cure was very tedious. Had the galvanic current been used at the commencement, and strychnia administered daily, the cure would have been rapid.

No disease coming under our observation is more satisfactorily and successfully treated by electricity than facial paralysis. But we need both currents, faradic and galvanic. It is true, we may succeed occasionally with the faradic current alone, in which case the pocket instruments of Gaiffe, or Kidder, illustrated in a previous chapter, will be found convenient and effective. But when we know the galvanic current is required in so many cases, especially at the commencement, and in making out a diagnosis, it is advisable, and even *profitable and practical* to have at hand two instruments, a faradic and a galvanic. Or, what is more convenient still, an instrument combining both currents like that of the McIntosh make, illustrated in the fore part of this work. These instruments are perfectly satisfactory in every regard. They are portable, easily managed, and in a few seconds' time we can change from the faradic to the galvanic current, or from the galvanic to the faradic current.

When a case of facial paralysis comes to us, our first business is to ascertain whether it is a case of central or peripheral paralysis. The manner of doing this has been described. The next thing is to apply the proper current. If the muscles contract

under the faradic current, this is the one to use. If they do not respond, then we resort to the galvanic current. In both cases we place the electrode of the positive pole immediately in front of the ear, while that of the negative pole is moved about over the cheek of the affected side. The current should be as strong as the patient can well bear, and the sitting should last from ten to fifteen minutes, and be repeated for the first week every twenty-four to forty-eight hours, according to the severity of the case. After this, especially if improvement be manifest, the application may be made twice a week till the cure is perfect.

All this applies to cases supposed to be curable. In cases of a central origin, like that of Mrs. A., previously described in this work, it will be found that electricity, no matter in what shape or form applied, will be of little avail. In fact, I think it may do harm in some cases. By referring to this case the reader will see that we commenced to treat Mrs. A. about the middle of September, 1881, and that we continued the treatment for about six weeks, when she got discouraged and applied to another physician. We heard no more from the case till December 19th, 1881, when the husband again called me. I found the patient in bed. I learned that after leaving me she went to an electrician, a man who gives special attention to the treatment of diseases with electricity. She told me that he had treated her eight or nine times, and that he had applied the galvanic current so strong to her face that she suffered severely from it; and that instead of any improvement, she had steadily grown worse from the time she went to him. She had quit him and was taking iodide of potassium and bromide of potassium under the instructions of one of the best physicians in the city. But with all of this she was growing worse. She suffered from a severe pain in the head, on the right side, immediately behind and a little below the ear. The left eye looked red and watery. The right arm and hand, and the right leg and foot, were motionless. She could not move them the least; they were paralyzed. I put her upon strychnia and bromide of potassium. Strychnia $\frac{1}{64}$ of a grain every three hours, and bromide of potassium ten grains every four hours. Under this treatment the pain in the head ceased, and the eye improved in appearance—looked nearly

natural in color; but up to this date, January 10th, 1882, there is no improvement in the paralysis.

I certainly think the strong electric currents used by the electric specialist aggravated the disease in this case, and would earnestly warn the novice against the reckless use of this potent measure in serious brain troubles. While it is *the* remedy in all cases of a peripheral origin, either in the form of faradization or galvanism, it will not cure, or even benefit many cases of a central origin. Happily, the great majority are of the curable kind. They result from extrinsic causes, cold, injuries, exposures, and not infrequently we meet with cases as complications of neuralgia. All these cases are readily benefited by the use of electricity. Where a paralysis results directly from a neuralgia, we should apply the electrode of the positive pole immediately over the nerve affected by the neuralgia, and that of the negative pole over the paralyzed part.

Neuralgias are sometimes speedily relieved, and occasionally cured by the application of electricity. Aside from its use in curing paralysis resulting from neuralgia, electricity may be used to relieve the pain. In cases of long standing, and even in acute cases, and where the pain is localized, the part sore and tender under pressure, the application of a mild galvanic current, applying the electrode of the positive pole to the affected part, while the negative is held in the hand of the patient, will sometimes do more toward restoring the parts to a physiological condition than any means to which we can resort. If the galvanic current fails to give the desired results, then, we try the faradic current. But we find that the galvanic current is most frequently useful; it only occasionally happens that the faradic current is the best.

"In morbid states involving *sensibility* the faradic current is of little service. A very high tension current, with excessively rapid interruptions applied along the trajectory of a nerve, is sometimes serviceable in a neuralgia. The power to relieve pain is the property of the galvanic current. A descending stable current is, theoretically, the best form of application to relieve the irritability of a sensory nerve; but in practice, it is found that the direction of the current is of little moment, the relief being the same in what direction soever the electricity may be flowing.

It follows, then, of course, that the galvanic and not the faradic current is to be used in the treatment of neuralgia. The use of the faradic current in such cases is one of the medical delusions against which we must protest.

The injunction, in systematic works, to add a little salt to the water with which the sponge electrodes are moistened, is proper only in the case of galvanic applications to the face and head. In neuralgias of the extremities, especially of long standing, I am convinced that we should use powerful currents, and therefore make the applications with large electrodes, moistened, but not with salt water. Not sufficient attention is paid to the duration and number of the *seances*. In galvanic applications about the head the sittings should not exceed five minutes, but they may be repeated several—say three—times a day. In neuralgias the applications should be more prolonged, and should be repeated at short intervals. Much better results would be obtained in these affections, sciatica for example, if the applications for galvanism were fifteen minutes long, and repeated every three or four hours. These statements are based on some experience with these frequent applications, and are not merely speculative theories.”—[Bartholow.]

These observations agree with my own previous experience, except that I think the application of the electrode of the positive pole to the tender part is always more agreeable, and in no case less effective than the negative pole.

Referring to the use of the galvanic and faradic currents, we would make this observation: Heretofore medical practitioners desiring to test the virtues of electricity in medicine have almost invariably invested in faradic machines only. They probably get good instruments, and use them according to directions; but, like all other therapeutic measures, the faradic current will not meet all the indications, neither will it do all that can be done with electricity, and if we expect to succeed, we must use both currents. One current will be found best in a certain case, another in a second case, and in other cases both currents may be required. As we proceed we shall aim to point out the special indications for the different currents.

In a communication for the *Peoria Medical Monthly* for Nov 1881, Dr. R. J. Curtiss, of Joliet, Ill., very ably and instructively illustrates the value of the galvanic current in painful affections, and we gladly appropriate and reprint his observations, for they are in harmony with our own, and we know them to be faithful illustrations of galvano-thérapeutics. He says:

“There is no fact in therapeutics better verified than the power of a low tension galvanic current to relieve pain. A high tension current has less power in this direction, and still less if it is interrupted, while the high tension faradic current, most useful in anaesthesia, has very little power to relieve pain, and in some conditions will increase it.

“Galvanism will relieve pain independently of its effect on the cause of pain. In fact most pain remedies operate independently of the cause. It must be, however, that when pain, like sciatica, depends upon disease of the nerve itself that the galvanic current acts more or less by catalysis, upon the cause of the pain in the relief of the disease.

“The method by which galvanism acts, or the changes of a physical, chemical, or so-called vital character which are produced in the tissues in the relief of pain are probably better understood than the same action of drugs. The first effect of the current is a physical one, and operates on the molecules of tissues. If the action is increased it becomes more complex and has a chemical effect. These effects of galvanism are termed catalytic, and it is by this action that electricity can relieve pain.

“*Case 1.*—Mr._____, a bricklayer. This patient was obliged to stand in water at his work during one day. On the third day after he was unable to work on account of sciatica. The pain was intense, and the limb could not be moved without great increase of the pain. The extent of pain was from the point of emergence of the nerve from the pelvis to the heel. The foot was placed in warm water, which contained the negative pole of the battery,—the positive was applied at different points over the nerve. The applications were made twice daily, for three days, the direct current from twenty cells being used. Each application was followed by lessened pain and increased mobility of the

extremity. No medicine was prescribed. After the sixth application the patient was free from pain, and complained only of stiffness of the limb when walking.

“*Case 2.*—Mr. —, a carpenter by trade, had had sciatica for ten years, more or less in relation to pain and time. Two years before I saw him he was subjected to the operation of nerve stretching. The wound became troublesome, and finally was attacked by erysipelas, and three months elapsed before he recovered from the effects of the surgery and the accident. In this case a differential diagnosis was necessary between sciatica and locomotor ataxia. The pains in the legs at times resembled those of ataxia. The tendon reflex, however, was increased. There was no fault of co-ordination, or any other signs or symptoms of ataxia. He had been treated by a minister, he said, with electricity derived from an electro-magnetic machine. The nerve stretching and ministerial therapeutics did not relieve him. He stated, however, that he was free from pain while in bed with his wound, following surgical operation, but pain returned when he had recovered and resumed work.

“The electrical treatment of this patient was continued for three months and was successful. The applications were made daily as a rule, and variously applied in quality and tension as the effects justified. The treatment began with the use of twenty cells, which was increased by degrees to sixty, and finally to eighty—with the intensity diminished by the rheostat. The patient improved rapidly after the second month. As a rule each dose of galvanism was followed by relief of pain. If the intensity of the current, however, was great enough for him to sensibly feel it, it always appeared to increase the pain. I found that the quantity of electricity was what his case demanded with low intensity, which was a very different method from that employed by the minister. This patient was discharged over a year since, and has remained well with exception of stiffness of the muscles, and occasional ‘storm pains.’

“*Case 3.*—Mrs. E —, a married lady, aged 40, is neurasthenic, and says she had had neuralgia in different nerves and at different times, all her life. Among other trouble she had been subject to nervous headache—the pain being extreme in charac-

ter. I noticed that the dark hair contained tufts of gray, probably half a dozen in number, sharply defined, and which she believed had been caused by excessive pain. Without doubt the loss of pigment had relations to her neurasthenic condition. I was called to visit this lady on account of an attack of sciatica. I learned that she had adopted the blue glass treatment for neuralgia, and while setting in the blue light her pains all settled into the sciatic nerve. The pain, of course, was intense, and patient helpless. I was obliged to use in this case a faradic current of rather high intensity, and used the same daily with good effect for about a week, when the patient was able to resume her avocations and daily routine of a confirmed neurasthenic life. I was anxious to try in her case the 'central galvanization' and 'general faradization' methods of Beard and Rockwell, but a diagnosis of tuberculosis was made by another physician, who took charge of the case, and I think must have cured his patient of tuberculosis, for after three years she is as well and as sick as ever.

Case 4.—Was a robust, hearty person, who had sciatica for six weeks' duration, which he got by working in water which flowed from the savory Illinois and Michigan Canal. He said he came up to have me use my big battery on him, as he had tried a little one with no good effect. I applied the direct current from twenty cells, which was very unsatisfactory to the patient, who insisted that it was of no account because he couldn't feel it. By way of scientific experiment, therefore, I turned on sixty cells and interrupted the current. After the 'seance' was over, in about five minutes, the patient complained of an increase of pain. He returned three times, in as many days, and I applied the current in the same way with the same effect. He then staid away, and I met him on the street about ten days after, when he informed me that as soon as he stopped the electricity he began to get well, and recovered in a few days without treatment of any kind.

Case 5.—Mrs. —, married lady, aged 55, had schirrus of the liver. The pain from this disease was unusual, and prevented sleep, took away her appetite, and made her wish for the coming of the inevitable end. She had taken morphia and atropia, codeia, chloral, and even inhalations of chloroform. To

relieve her of pain I used the direct galvanic current from fifteen cells daily, about fifteen minutes, with the happiest effect. So long as she used this treatment she was comparatively free from pain, and availed herself of it until she could no longer, from progress of the disease, come to the office. The tumor filled the epigastric region and extended into the iliac fossa. Her last days were painless, and hopeful of cure, under the ministration of a 'cancer doctor' from Chicago.

"*Case 6.*—Mr._____, aged 60, had pulmonary consumption (fibrous phthisis), of which he died after two years duration of the disease. His cough was excessive, and he suffered greatly during the last six months from this source and from intercostal neuralgia, and pain referred to the left shoulder. Various anodynes and Sequard's neuralgic pills were prescribed. As an experiment, galvanism was used. Galvanization of the cervical region and epigastric region—one pole beneath the ear and the other over the stomach—with a current from five cells used for ten minutes, would insure a good night's rest—comparatively free from cough and pain. He also found relief from night sweats by use of faradism lightly applied over the surface. From choice the patient used galvanism for pain and faradism for sweating, instead of drugs. This patient after he began the use of electricity had a remarkable increase of appetite and digestion. He could take and digest three ounces daily of cod liver oil, and took daily a large quantity of raw beef and brandy, this remedy having been prescribed for him as the latest therapeutical novelty from Paris. His life by this means was surprisingly prolonged and his comfort greatly increased.

"*Case 7.*—Mrs._____, aged 53, had a cancer of the left breast, badly ulcerated. The pain in and about the tumor and through the chest, which at times amounted to angina, she was in the habit of relieving as much as possible by hypodermic injections of morphia. Hearing about the effects of galvanism in relieving pain in similar cases, she reported for that purpose. In this case the treatment by galvanism was remarkable in procuring relief from distress. The galvanism was used every other day by applying the positive pole over the dorsal and cervical spine, and the negative at various places over breast, side and arm. She

stopped the use of morphine while being treated by galvanism, and was relieved of immense suffering by its use. She had used plasters, probably arsenic and zinc, for the cure of the cancer, and declined further treatment than what was calculated to relieve her distress."

These are reports of seven cases where electricity was used to relieve pain. Galvanism was the principal resort, but in case "5" Dr. Curtiss says he "was obliged to use a faradic current of rather high intensity." But he does not say why he did this; and we are frequently at a loss to know which current to use, the faradic or the galvanic. In painful affections we are guided by these symptoms: where firm pressure over a painful part increases the pain, the faradic current will aggravate, while the galvanic current will relieve. On the other hand, where pressure does not increase the pain, then the faradic current, the positive pole over the painful part, will give relief.

A little experience in the treatment of neuralgia will enable the practitioner to classify his cases properly. On the one hand he will have patients who manifest a fair share of vitality, and yet they suffer from acute neuralgia, about which they complain bitterly. Touch these people and they are nervous; and handling the diseased or painful parts cannot be tolerated. Galvanization is soothing to these patients and will cure. On the other hand we find a class of rather feeble people, suffering from impairment of nutrition, more or less anemia, hyperesthesia, exhaustion, &c. Holding the hands and rubbing the heads of these patients will give relief, and such measures are enjoyed as real luxuries by this class. They even fall asleep under such treatment. Here is the place for the faradic current; localized or general faradization. Mild currents should be used at first, then stronger, always being careful to avoid currents of high tension about the head and face. And large sponges should be used, that the current may be diffused as much as possible, for the concentration of current about the head and face cannot be well borne, and may aggravate the pain, while a diffusion over a large surface affords quick and permanent relief. Nothing so speedily improves nutrition, relieves pain and hyperesthesia in such cases as faradization, local or general, as may be required.

Other diseases associated with or dependent upon impairment or perversion of nutrition, besides those of a neuralgic character, are frequently met with and quickly and permanently cured with electricity.

A case.—Lilly B., age fifteen, was brought to me about the middle of August, 1881, for advice regarding a curvature of the spine. Upon inquiry I found that she had been under treatment for nearly a year without benefit. She had menstruated once or twice, when about fourteen, but never since. She was wonderfully bent over in a forward direction. The difficulty did not seem to be in the spinal column, but in the muscles of the back. The girl seemed to lack the power to hold herself up, and she could not straighten herself without some help. She could get up and walk about in a half bent attitude, but would get very tired in a short time. Even sitting up in a chair was a burden to her; made her very tired. Her appetite was poor, face looked pale, pulse rather feeble, and all the functions of the body were performed in a sluggish manner, and some of them, especially menstruation, were suspended.

Our first advice was to have Mr. Schleifarth make and fit a suitable brace on the patient, which was done at once. This held her up temporarily, and with this on she could sit up and walk about without getting so tired. This brace was so constructed that it could be removed in a second or two, and replaced as readily. In addition to this we had her come to the office three times a week for electrical treatment. Faradization was used thus: The back was bared the entire length of the spine, and we had the patient hold the sponge electrode of the positive pole of the faradic machine in the hand, first in one hand, then in the other, changing every minute, while we applied the sponge attached to the negative pole to the back, commencing at the neck, and moving down the spine to the lower extremity, then up one side, down the other, then up, then down the centre, using as strong a current as could be borne without discomfort, and continuing the seance for fifteen minutes. She always felt refreshed and invigorated after these treatments. Small doses of strychnia and macrotys, occasionally alternated with arsenic, were given from the start. We continued this treatment about one

month, when we observed a marked improvement in the appearance of the patient. The appetite was better, sleep more refreshing, and she really felt stronger. Faradization was continued twice a week after this, for another month, when she had a slight show of the menses. She was still improving. Another month under the same treatment, and the menses appeared in a natural manner. She now looked red and fresh, had gained greatly in flesh, could sit up, and could walk and work with pleasure. We continued the faradization once a week till December 15, 1881, when we stopped, and she is now taking nothing but macrotys and strychnia, and is growing and gaining in strength daily. She still wears the brace, but says she can do without it, and she can really straighten herself up nicely and get around like other girls. We shall soon take off the brace.

Now, here is a case where faradization worked a wonderful cure. True, it may be said that strychnia, arsenic and macrotys had something to do in the cure. So they had; but they could not infuse new life and vigor into the muscles, and invigorate the nervous system so rapidly as actually resulted in this case. The very first seance was followed by immediate improvement, and the patient could even feel and realize that the electrical treatment was restoring her. And there is no doubt but that the indirect and constitutional influence of the faradization had more to do in re-establishing the menses in this case than anything else. Of course the faradization was comparatively local, and while we are sure the poorly nourished and feeble muscles of the back increased in size and gained in strength under the electrical influence, we are quite certain that the uterine and ovarian functions were stimulated also. As evidence tending to establish the fact that such things may result under similar circumstances, allow us to quote a paragraph or two from Prof. Rockwell:

"Localized electrization of poorly nourished and atrophied muscles develops size and increases strength. Localized electricity of any organ, such as the uterus, the nutrition of which has become impaired, and its size diminished, tends to develop it and to increase its functional activity. In localized electrization, these results are, of course, of a local nature; yet, owing to the fact that absolute localization is impossible, we not unfrequently ob-

serve effects extending far beyond the parts actually enclosed in the circuit.

"By reflex action, also, we obtain remote effects, which are either desirable or undesirable, according to the demands of the case in hand. Galvanization of the spine, and even of the extremities, may, in certain irritable conditions, excite the characteristic metallic taste. Galvanization, and even faradization of remote and limited areas, sometimes relieves pain, induces sleep, and increases the menstrual and other discharges through reflex influence alone."

This was undoubtedly the case with our patient; and we have seen similar results in other cases, where the appetite increased, digestion and general nutrition improved under the influence of faradization, administered over very limited areas, through the electrical chair of Dr. Hathaway, of Chicago, when the hands and feet only of the patient are in contact with the electrodes. While localized faradization is certainly more potent in some cases, where it is practicable, we do know that special results actually follow general influences in many cases.

One thing should always be observed in the application of electricity, no matter whether we are using the electro-magnetic machine or a galvanic battery: the positive pole should always be applied to sensitive, painful or inflamed parts or organs, when such conditions are present. And while the positive pole is applied directly to or over these tender parts for the purpose of relieving pain and effecting cures, the negative pole should be placed upon some comparatively unimportant part of the body, and where the least excitement is produced. On the other hand, where it is the object to stimulate or invigorate any part or organ, the negative pole should be applied to the weak part, while the positive pole is placed upon some part of the body not likely to suffer serious injury from the sedative influence of the positive pole.

It will be observed that in case I., reported by Dr. Curtis, a severe case of sciatica was speedily relieved and permanently cured by the use of electricity; and that the positive pole was applied to the painful part, while the foot of the patient was held in warm water containing the negative pole of the battery. And in the case of Lilly B., reported by me, the negative pole was

applied to the back, all along the spine and over the muscles of the back, while the positive pole was held in the hand. A wonderful cure of spinal curvature and suppressed menses was the reward of this treatment. And we might cite the reader to numerous cases illustrating the truth of this law.

Dr. A. W. Tipton, in his new work on Electrical Medication, p. 56, illustrates the distinctive use of each pole very clearly. While the terms electro-vital fluid and electric fluid may be objectionable, Dr. Tipton makes the reader know what he means, and his instructions are eminently practical. He says: "The reader will bear in mind that all acutely inflammatory or hypersthenic affections are electrically *positive* in excess—having too much vital action—being *overcharged* with the electro-vital fluid; and that all paralytic diseases, or those of sluggish, azoödynamic character, are electrically negative, having too little electro-vital fluid, too little vital action. It is a universal law of electricity that positives repel each other, and that negatives repel each other; but that positives and negatives attract each other. This is a principle of electric action everywhere known where any thing is known on the subject. *We appropriate it practically to therapeutic purposes.* Therefore, when I wish to repress or repel inflammation, which is electrically positive in excess, I put the positive pole to it; or, at least, I bring it under that half of the circuit with which the positive pole is connected, and as near to the pole or electrode as possible. And because two positives repel each other, and also because the direction of the current is always from the positive to the negative pole, carrying the electro-vital fluid with it, either I must withdraw my positive electrode, or that excess of electro-vitality in the diseased part which makes it morbidly positive, and thus produces inflammation, must give way. I *will not* withdraw my positive pole, and therefore the positive inflammation *must* retreat and be dispersed. In treating this case, I will place my *negative* electrode either on some healthy part, or, if there be perceptible anywhere in the system a morbidly negative part, as is often the case, I will place my negative pole there. For example: if I am treating for *nephritis*—inflammation of the kidneys—when I do not perceive any part to be abnormally negative, I manipulate with my positive electrode over

the inflamed kidney, having the negative electrode placed at the coccyx, the lowest part of the spine. My positive pole repels the positive inflammation from the kidney; or, rather, repels from it that excess of electro-vital fluid which makes it morbidly positive and induces the inflammation, while the negative pole attracts the same towards the coccyx. On its way it becomes more or less diverted to adjacent nerves; or, if gathered in the healthy part, under the negative pole, it is immediately dispersed by the normal circulation as soon as the electrode is removed. But if I find *a spinal irritation*, say in one or more of the cervical or dorsal vertebræ, and, at the same time, a stomach affected with *chronic dyspepsia*, accompanied with *constipation of the bowels*, I will work over the inflamed or irritated spine with my positive pole, because I know from the irritation that there is an excess of electro-vital fluid in the part, making it improperly positive; and, with my negative electrode, I will, at the same time, treat over the stomach, bowels and liver; because I know, from the *inaction* of these organs, that there is a lack of vital force, a deficiency of the electro-vital fluid, there, and that, consequently, they are too negative."

Dr. Tipton is earnest and enthusiastic regarding these principles, and whether we agree with him in all his theories and details or not, the one idea advanced, and so fully illustrated in the above quotation, is one that cannot be treated with indifference if we expect to succeed with electricity. The distinctive use of the poles should be carefully observed under all circumstances. Where doubts arise as to the actual conditions of a part, then we may alternate, and finally use the pole that seems to give the best results.

We have now defined electricity, explained the different methods of generating it, described the leading and most practical electro-magnetic machines and galvanic batteries in the market, illustrated the difference between the electro-magnetic and galvanic currents, and have shown the marked difference in results from the application of the different poles, referring to specific conditions where each pole has a specific action in relieving pain or restoring vitality. The knowledge thus far gained from these pages should be sufficient to enable any intelligent physician, who

has a practical knowledge of disease, to commence the use of electricity understandingly.

CENTRAL GALVANIZATION.

Central galvanization is a method of applying electricity that demands special attention. It consists essentially in bringing the brain, sympathetic, spinal cord, and pneumogastric, under the influence of the galvanic current. One pole of the battery is placed over the region of the stomach, while the other is applied to some part of the head or spine. In all cases of cerebral excitement, pain in the head, mental disturbances from sympathy, apply the negative pole of a galvanic battery over the stomach, and the positive pole to the top of the head. Great caution should be observed in applying the galvanic current to these parts. In all cases the head and face are more impressible than other parts of the body, and this is especially so with the galvanic current, for it passes directly through the scalp and skull, enters the brain and goes through every nerve and tissue it meets. In using this current in any case in the manner denominated central galvanization, the electrodes should be large, so as to diffuse the current as much as possible. And we should commence with a very mild current, one or two cells, increasing gradually as the patient can bear it. And we should not depend upon the suggestions of the patient too much regarding the strength of the current, for bad results may be suffered before we are aware of any danger. Suppose the patient is suffering from pain in the head, or there is cerebral excitement, and we desire to relieve it with electricity. Let the patient be seated, bare the stomach and make the top of the head quite wet with warm water. Now attach two large sponge electrodes, well moistened with warm water, to the cords of the battery, turn on two or three cells only, then apply the sponge of the negative electrode over the stomach, and carefully test the patient and the strength of the current in this manner: while the negative electrode is still over the stomach, we take up the positive sponge electrode, and with a tapping motion about the temple, or over the brow, we rapidly apply and remove the sponge. If the patient is quite sensitive,

we may expect to hear remarks like these: "O, I see sparks! I see flashes of light when you hit my head with the sponge." If no such results as these follow this test, then connect two or three more cells, and repeat the experiment. If the battery is in any thing like good order, from four to six cells will certainly give the results above named—sensations expressed by the words sparks, flashes of light, etc. But some people are not very sensitive, and ten to twelve cells may be required to excite any unusual manifestation. On the other hand, we frequently find people who are so sensitive that but two or three cells can be tolerated.

Having carefully tested the strength of the current and the impressibility of the patient, while the negative electrode is still over the stomach, we carefully place the sponge of the positive pole on the top of the head and steadily hold it there for a time—from one to fifteen minutes, as may be determined by the immediate effect. The moment we place the sponge on the head the patient complains or speaks about a peculiar metallic taste in the mouth. If this is not mentioned voluntarily, it is called out in answer to questions. Occasionally it is complained of greatly, and seems to be quite disagreeable to some people. In other cases it is barely perceptible. Central galvanization with the negative pole to the stomach, and the positive pole to the head, is a potent measure, and if it does no good, it is likely to do harm. It lessens the quantity of arterial blood in the brain, and if used too strong, or continued too long, dizziness is experienced, and if still further continued the patient becomes unconscious and falls from the chair in a condition of syncope, and vigorous efforts, with the application of stimulants, may be required to bring about a reaction. From this it will be seen that great caution should be observed in the application of this measure. If the patient complains of dizziness, then the current should be lessened in tension; and if the dizziness is still suffered, a rheostat may be used. The rheostat is very convenient in applying electricity to the head, eyes and ears. It is fully described and its use illustrated on previous pages. But with the greatest care and the use of the rheostat some patients cannot bear central galvanization long at a time. We observe the face growing pale,

and the patient sighs a time or two, or expresses feelings of weakness or depression, and we are forced to desist. One or two minutes is as long as we can use it in such cases; in others it will be well borne for ten or fifteen minutes.

We use central galvanization in obscure nervous affections, such as hysteria, hysterical insanity, chorea, nervous headache, etc. Some of the most persistent cases of hysterical insanity are speedily relieved and permanently cured by this measure. Just how the cure is wrought we cannot always tell. But we do know that the galvanic current is capable of working wonderful changes. With it we can disturb nervous influences, divert the circulation, separate the constituents of the fluids of the body, and even dissolve the tissues. An agent capable of doing all this may be expected to do either good or harm whenever employed. We may apply the faradic current to the extent of toleration, and rarely do injury with it, for it has no power to disorganize the fluids or dissolve the tissues. In changing from the galvanic to the induced current the electrolic power is lost. Faradization influences nerves and muscles principally; the galvanic current produces a change in everything coming under its influence; and the changes are not always simple excitements, contractions and relaxations, but are organic in character.

The application of electricity to the head is opposed by some electricians, because they cannot explain just *how* central galvanization cures. And because bad results may come from reckless manipulators, they oppose and denounce it. We are not of this class, for we have cured some troublesome cases with central galvanization that had resisted various measures. Of course we should be cautious at the commencement, and if we find that the current is not well borne, and that the patient grows worse under the treatment, it need not be continued. Two or three sittings will be sufficient to test any case, for if the results are to be good a few seances will decide it.

Central galvanization is sometimes applied by placing the positive pole to the stomach and the negative to the head, or over different points along the spine. But the most satisfactory method is to apply the negative electrode over the stomach, and the positive pole to the top of the head, nape of the neck, or over

the upper portion of the spine. Spinal irritation is sometimes instantly relieved by this measure. It is even astonishing how quickly harrassing pains and feelings of distress vanish under the influence of galvanism. And some cases of persistent nausea, no doubt from spinal irritation, are immediately relieved by this measure.

We meet with many patients where the symptoms are delusive. We find it impossible to make out what we call a positive diagnosis. We may be able to find a positive wrong here, and another there, and we may apply the appropriate remedy in every such case, but still there lingers a nervous distress, melancholy, or wakefulness, and the patient may suffer from fits of sobbing—don't feel right at any time. With other appropriate measures we now resort to central galvanization. Of course we cannot always know, to a certainty, that they will relieve the patient, but we frequently find that improvement commences at once. Just how the favorable change is wrought we do not pretend to explain, but we do know that with central galvanization we can frequently relieve, and many times speedily and permanently cure people who had lingered for months under different plans of treatment, medical and hygienic.

ELECTROLYSIS.

Electrolysis is a term applied to the process of decomposing compound substances by electricity. For this purpose the galvanic current, not the faradic, must be used; and that this direct current is capable of separating the elements that enter into the composition of fluids and solids is readily illustrated, as follows: Let us dissolve about thirty grains of iodide of potassium in two ounces of water. We put this solution in an open dish, on a suitable table, and observe that it is colorless. We now attach conducting cords to a galvanic battery, and on the distal ends of these cords we attach metallic electrodes, iron, copper or platinum. We now dip both of these electrodes into the iodide solution, at some distance from each other, and hold them there for a few minutes. Very soon we observe that the solution about the electrode attached to the positive pole of the battery changes color. It looks yellow at first, but rapidly grows darker, and

finally the whole solution presents the full color of iodine. In this case the iodine and oxygen go to the positive pole, while the hydrogen and alkali go to the negative pole. In all cases of electrolysis, or wherever the poles of a galvanic battery are applied, the acids and oxygen present go to the positive pole, and the alkalies and hydrogen go to the negative pole.

Now it is well known that the human body is largely made of water, holding salts of potash, soda, &c., in solution. It is also a fact that the composition of the fluids and tissues of the body thus made up are readily decomposed in the living subject, by the application of the poles of a galvanic battery, the acids and oxygen rushing to the positive pole, while the alkalies and hydrogen as rapidly concentrate about the negative pole. In a given case, where metallic electrodes are applied directly to a part, the electrode attached to the positive pole is corroded; and if a strong current from many cells is used, the accumulation of alkalies at the negative pole may be so great as to produce a severe caustic effect. Such a result is rarely desirable, and unless we want it we are careful to avoid such violent action, by using a smaller number of cells. In either case, whether few or many cells are used, but especially where the current is strong, morbid growths, swellings, tumors, and enlarged glands are frequently dissolved and carried away in a very short time by subjecting them to the process of electrolysis. Just how this disturbance of the elements in the tissues results in the removal of the diseased conditions referred to, we are not at present able to tell. Of course, in certain cases, where we use electrolysis to the extent of destroying the tissues, the effect is similar to the operation of an ordinary caustic, only the pain and subsequent inflammation are not so great, while the cure is more certain.

A few cases in practice will serve to illustrate electrolysis, and the appropriate instruments in making the applications. A young lady, aged 22, otherwise healthy, came to me last fall, September, 1881, asking advice about an enlargement of the parotid gland. She said the lump had been coming for several months, and that, notwithstanding she had consulted two doctors, and had used their medicines, the gland continued to enlarge. When she came to me it was large enough to make her appearance quite

unsightly, and she was very anxious to have it reduced, or removed—anything to get rid of it. She suffered from no pain, neither was the gland tender under pressure; no increased redness, but the tumor was very hard.

Treatment.—I attached conducting cords to a twenty-four cell zinc-carbon galvanic battery, McIntosh's, and on the distal end of the positive pole I attached a large sponge electrode. On the distal end of the negative pole I attached a small sponge electrode. I moistened both electrodes with warm water, and placed the one attached to the positive pole in the patient's hand. The small electrode, attached to the negative pole, I placed firmly on the tumor, and held it there for fifteen minutes. After fixing the electrodes as above described, I connected six cells of the battery. This produced a sensation of warmth in the tumor, or in the skin covering it. I carefully connected more cells, one by one, till a distinct burning sensation was complained of, but I did not remove the sponge from the tumor till the fifteen minutes were up. I did, however, move the sponge about over the tumor during the whole time of the operation. I did this to prevent a caustic effect. When I removed the sponge at the end of the fifteen minutes, the skin covering the tumor was very red. I had this patient return twice a week for a month, and I could see a decided improvement. The decomposition of the fluids in this tumor, effected by the application of the negative pole externally, was resulting in a gradual dissipation of the enlargement. But the process seemed slow, and we determined to resort to a more direct method of application. Instead of using a small sponge electrode on the negative pole, I attached an electrolysis needle. This is a harpoon shaped needle made expressly for the purpose. About a half an inch of the pointed end is left exposed; the remainder of the needle is carefully insulated with guttapercha. These needles are kept in stock by surgical instrument makers, and can be had of different sizes, styles and shapes, already insulated and ready for use. One of these needles attached to the negative pole, as above stated, and the sponge attached to the positive electrode placed in the patient's hand, I thrust this electrolysis needle into the center of the tumor. This was readily done by picking up the tumor between the thumb and fingers, and

giving the needle a quick motion, as in introducing a hypodermic syringe. I now turned on six cells. The patient complained a little of a burning sensation, but she could bear it stronger, and we carefully connected other cells, one by one, till twelve were included in the circuit. This was all done in a minute or two. By this time the needle seemed quite loose in the tissues, and I could turn it about in any direction. I took advantage of this and did turn the point in different ways, and by the time the fifteen minutes were up, the time usually occupied in electrolysis seances, the needle seemed to be in a free space. I now turned off the battery, withdrew the needle and dismissed the patient for a few days. But little inflammation resulted from this operation, and scarcely any soreness was left after three days. The tumor had rapidly shrunken, and by the use of sponge electrodes applied externally after this twice a week, it speedily diminished in size, and finally disappeared entirely.

It should be observed that in the introduction of electrolysis needles into deep tissues, they should always be introduced so that a part of the insulated portion of the needle goes beneath the skin. This protects the skin from the electrolic effect of the current, and saves the patient from great pain.

While tumors, swellings and enlargements of various kinds may be reduced in size, and finally removed by external electrolysis, where it is practicable, the introduction of needles into the tissues will result in a more rapid dissipation of morbid growth. And, in some cases, it is required to introduce these needles quite a number of times; in others, one application is enough. Take a wart on the hand or face for instance. Let the patient take the sponge of the positive electrode in the hand, while we apply an electrolysis needle, attached to the negative pole, to the little tumor. The needle should be well fixed in the wart before the current is turned on, and then one or two cells at a time should be connected till the current is the required strength. The needle should not be taken away during the operation, for every time we take it off and reapply it we break the current, and this produces a shock which unnecessarily annoys the patient. We may move the needle about a little, so as to completely disorganize the whole tumor during the one operation; but we should

be careful in moving the needle that we do not, at any time, lift it from the tumor. When done, before removing the needle, and this should be observed in all cases, disconnect the cells, or turn them off.

In all such cases as these the operator will be governed by the results in the number of cells used. First turn on two or three, and if but little effect is produced, connect others, and continue to increase till a burning sensation is complained of, and the tissues at the needle turn white, and the needle loosens. Fifteen minutes is long enough for any operation in electrolysis.

Some operators apply the sponge electrodes of both poles to the diseased parts, only at different points; and they attach electrolysis needles to both poles of the battery, where needles are used, and they thrust both needles into the tissues, only at extreme points. This may be better than the plan we have practiced and suggested, but we doubt it very much. We have tried it, and could never discover any advantage. And the needle of the positive pole, unless well covered with gold, is so corroded and the tissues so hardened about it that at the end of fifteen minutes it is removed with difficulty. A sponge on the positive pole, held in the hand, and a needle on the negative pole is all sufficient—*the best*.

Electrolysis, applied in different ways, is a potent measure in such diseases as goitre, benign and malignant tumors, mother's marks, chronic rheumatic swellings, &c. In fact this is one of the most valuable therapeutic uses of electricity, if not really the most important of all. The current should be as strong as can be borne, and if necessary anaesthetics, local or general, should be used.

THE REMOVAL OF HAIRS BY ELECTROLYSIS.

Electrolysis is successfully resorted to for the removal of hairs from the face, when it is desirable to have them permanently removed. Frequently the opinion and advice of the physician is sought by women respecting this abnormal and obnoxious growth. This growth of hair on the face of a lady is not always a trifling matter. It may not kill the patient, but it is almost certain to occasion great annoyance. It is very apt to affect her disposition,

and to injure her prospects in life, especially if she be young and unmarried; and it may eventually ruin both her health and her happiness by producing a mental disquietude which in many instances urges on melancholy.

These observations, from a paper written by George Henry Fox, A. M., M. D., read before the Medical society of New York, with the following detailed procedure for the removal of this offensive growth, taken from the same paper, may interest a few, and it would leave our work incomplete to omit this use of electrolysis:

“ The operation for the permanent removal of hairs by electrolysis, has been described by several who have written on the subject, and the descriptions differ merely in a few non-essential points. The operation is a simple one, which any physician with a steady hand and keen eye can readily perform, although, as in many other simple operations, a peculiar dexterity is required, and far more satisfactory results are obtained after a certain amount of experience. An ordinary galvanic battery is required and a fine needle, which is to be attached to the negative cord. The number of cells required for the operation depends upon the activity of the battery, the delicacy of the patient’s skin, and the strength of the hairs to be removed, and should be determined in each case by the effect which is produced. I commonly use from ten to sixteen cells of a zinc-carbon battery, or a corresponding number of a chloride of silver battery.

“ Upon the style of needle employed depends, in a large measure, the success of the operation. A fine cambric needle, which has been recommended, may be successfully used, but on account of its stiffness it is more difficult to introduce it into the follicle without piercing the follicular wall than the hair-like flexible steel broach which I have recommended and invariably use. The cambric needle being larger is also productive of more inflammatory reaction, and more likely to leave permanent traces of the operation. Formerly I used a very fine platinum wire, pointed by means of a jeweler’s file, but the delicate flexible broach, much finer than those commonly employed by dentists in extracting nerves, is far superior to any other needle which I have ever seen, and is almost a necessity in removing the hairs from the upper

lip without the production of a scar. The needle can be readily attached to the end of the battery cord by a few turns of copper-wire protected by an inch or more of rubber tubing, or a special handle may be made for the purpose.

“ Provided with battery and needle, the next thing is to get the patient in a proper chair and in a proper light. A high reclining chair and a southerly bay-window are desirable, but the main point is to secure sufficient light and to have the operator’s eyes upon a level with the patient’s chin. The needle is now introduced into the follicle by the side of the hair. If this is skillfully done, no pain whatever is felt by the patient. The sponge-cup or sponge-tipped positive electrode should now be used to complete the circuit. This may be applied to the skin in the immediate vicinity of the hair, if but a few cells are used, but it is usually more convenient to allow the patient to hold the positive electrode in one hand, and when the needle has entered the follicle, to ask her to complete the circuit by applying the moistened sponge to the palm of either hand. The electrolytic action now manifests itself subjectively in the form of a sharp stinging sensation, and objectively in the form of slight hyperæmia around the needle. In a few seconds the hyperæmia will give place to a blanching of the skin, and a little froth will appear at the mouth of the follicle. If the hair be now seized with a pair of forceps and the gentlest traction exerted, it will be found to be loose in the follicle in the course of from ten to twenty seconds, provided the needle has been skillfully introduced. Before withdrawing the needle the patient should remove her hand from the sponge, in order to avoid the slight shock which would otherwise be felt.

“ In a paper on this subject which I read before the New York State Medical Society, three years ago, I recommended the extraction of the hair before introduction of the needle where the follicles were of large size. Under no circumstances, at the present time, do I ever remove the hair until it is loosened by means of the electrolysis.

“ At that time I was in the habit of using a much coarser needle than I do at present. With the finest flexible needle it is extremely rare to produce wheals or pustulation. In many cases the effect of the operation is simply to leave red points, which soon disappear.

“ The operation is by no means a pleasant one, but rarely does a patient make any complaint of pain. The majority say it is not as unpleasant as having teeth filled in a dentist’s chair, and with the fine needle the painful sensation is greatly reduced. At the first sitting the patient is often nervous, and suffers really more than in a dozen subsequent operations. When the sitting is prolonged, and especially in a poor light, the removal of the hair is very trying to the eyes of the operator. At certain times I know that I have suffered quite as much or even more than the patient. The use of a lens held in the hand or fixed before the eye has been suggested, but for my part I find one of no value. A delicacy of touch and steadiness of hand is more essential in this operation than an unusual keenness of vision.

“ As to the number of hairs which can be removed at one sitting, I would say that from thirty to fifty is the number which I usually expect to destroy in an operation lasting three-quarters of an hour. Upon the neck it takes much longer to destroy hairs than upon the chin or cheeks. I have removed over two hundred hairs at one sitting, when patients from a distance were anxious to leave the city; but I deem it far better to spare one’s eyes and to be more thorough, even if it involves a greater number of sittings.

“ If the operation is very skillfully performed, it ought not to leave scars, as a rule. In some cases it is impossible to prevent the production of minute punctate cicatrices, which, however, can only be seen on close inspection. I made a mistake in some of my earlier cases in operating upon two or more coarse hairs very close together, instead of taking one here and there at short distances apart. A little attention to this hint may serve to prevent the production of slight scarring by those who may attempt the operation. Here again I must refer to the fine needle, for its use greatly lessens the liability to the production of scars.

“ As regards the immediate success of the operation, it must be stated that, as a rule, a certain percentage of hairs will return and demand removal a second time. I used to expect a return of from thirty to fifty per cent of the hairs, while now I am surprised if from five to ten per cent reappear. In one case in which I removed over fifty hairs with unusual care, not a single one has

returned after an interval of three months. In some patients the growth of hair appears to have ceased, for some unknown cause, and when the hairs are destroyed the cure is effected. In other patients the fine hairs are constantly growing larger and darker, and after the most conspicuous have been removed a new growth will in time succeed, and appear, perhaps, like a return of those previously removed.

“ In this operation for the permanent removal of hair the question arises as to how the electricity destroys the papilla from which the hair springs. Is it by thermic or by electro-chemical action? A recent writer on the subject objects to the use of the term electrolysis as being a misnomer, claims that the heat generated in the needle by the passage of the electricity is the active agent in the destruction of the tissue, and suggests for the operation the name of *akido-galvano-cautery*. It cannot be denied that in this operation the temperature of the needle is slightly raised by its resistance to the galvanic current, but surely not to such a degree as to produce a caustic effect. On the other hand, it is evident, from the frothing seen at the mouth of the follicle and other effects, that a decomposition of the water and salts contained in the cutaneous tissues is taking place around the needle and causing the escape of bubbles of hydrogen. This is certainly nothing more nor less than electrolysis.

“ In conclusion, I would like to refer to the cause of facial hirsuties in females, and I shall speak briefly on this point, for I know very little about it. I have wondered and pondered by the half-hour while operating on cases, and endeavored to find some characteristic common to all of my patients, but in vain. Some are in fine physical condition, while others are debilitated. Some are extremely nervous; some are not so in the slightest degree. Some are stout and others thin. Some are of dark and others of light complexion. Some are maidens from twenty to fifty years of age; while of others who are married, some have children and some have none. The somewhat common idea that the growth of a beard in the female is necessarily associated with masculine traits of character is certainly not founded upon fact, for most of my patients have presented the very highest type of feminine refinement. That facial hirsuties is dependent upon a malforma-

tion or imperfect development of the reproductive organs, as some have claimed, is, in my opinion, doubtful. Certainly, an intimate relation between these two conditions has not been satisfactorily proven, save in a few exceptional cases.

“ The relation of facial hairiness in females to derangement of the nervous system is a subject which has already commanded attention, but has not as yet been sufficiently studied. I have already spoken of the depressed mental condition existing in many of my patients, and which I believe to be not merely a result of the disfiguring growth of hair, but a symptom of general nervous disease, upon which the hirsuties in all probability depends. Excessive growth of hair, whether in the male or female, is an aberration of nutrition, and not a sign of excessive vitality. The Samsons of the present day are clean-limbed, and usually short-haired specimens of the human race, and in our highest type of feminine health and beauty there is but a moderate growth of hair. The lady in the museum, whose luxuriant tresses trail upon the floor, is rarely, if ever, well-developed, and, like her bearded sister, furnishes unmistakable evidence of perverted nutrition.

“ An abnormal growth of hair, whether it be in respect to length or location, indicates an abnormal condition of the nervous system. Precisely what this condition may be, and how it may be remedied, I must leave for others to determine.

“ In the following report of cases, I have selected twelve of those in which the growth of hair was more or less abundant, and which will serve to illustrate some of the difficulties in the way of treatment, as well as its success.

“ CASE I.—Mrs. ——, aged thirty-one, married at eighteen, and has one child. Is quite stout and in fair health. Is greatly worried by a growth of hair upon chin and neck. Seldom goes out for exercise, but prefers “ to sit and mope.” Her sleep is often disturbed by the thought of her “ misfortune.” The patient is almost a monomaniac on the subject of her beard, and most of the time is greatly depressed in mind. The growth of hair upon extremities is abnormal. The facial hirsuties appeared about two years ago, and pulling the hair out seemed to increase the growth. As a proof that pulling makes the hairs grow

stronger, she cites the fact that the hairs on the right extremity of upper lip, which she could pull more readily than on the left side, are now much more developed in size. There is no tendency to hirsuties among her female relations.

“Applied for treatment in March, 1880. During the summer I removed over a thousand dark hairs, leaving an abundant growth of fine pigmentless hairs, which were scarcely noticeable at the distance of a few feet. At her earnest request, I continued to operate upon these and removed a second thousand or more, most of which were so fine as to constitute no disfigurement whatever, but their removal produced a marked indirect effect upon her health and happiness. In this case about twenty-five hundred hairs were removed by count. How many of these reappeared and were removed a second time it is difficult to say. There was, evidently, a constant tendency for the fine downy hairs to develop in size and thickness, and at times I despaired of being able to effect their removal, but after eighteen months of intermittent treatment, success crowned my efforts, and her chin and neck appeared quite smooth and natural. In January, 1882, I saw the patient, at which time there were no conspicuous hairs, and she stated that she considered the operations to have been perfectly successful and that the results had far exceeded her anticipations.

“CASE II.—Miss —, aged twenty-four; a tall blonde, in good health. Applied for treatment in October, 1879, on account of a growth of light hairs on both sides of chin, about an inch in length. She had consulted the eminent dermatologist of London, Prof. Erasmus Wilson, and stated that she had been advised by him not to touch the hairs, and informed that absolutely nothing could be done in her case. Her extremities were quite hairy, and the hair of the head was thick and long. The hair on her chin had mostly grown during the previous year, and after a severe fever. In this case I removed three hundred hairs, operating upon the left side of chin by electrolysis, and upon the right side by the method suggested for the mechanical destruction of the follicle, consisting in the introduction and sudden twisting of a barbed needle. In April, 1880, the patient returned to the city, and I found that nearly all of the hairs upon the right side

had returned, while there was a perceptible diminution of the number upon the left side of chin, where the electrolysis had been employed. In April I removed one hundred and fifty, and in June one hundred hairs of a finer growth than those first operated upon, which left the face quite free.

“CASE III.—Miss —, a young lady, aged twenty-six; tall and of fair complexion; in good health, though delicate in appearance and inheriting a tendency to pulmonary disease. Applied for treatment in December, 1879, on account of hairs growing on either side of chin, which had appeared within three months. There was a very light moustache on upper lip, though scarcely more than is commonly seen. In two operations I removed sixty hairs from right side, and thirty-five from left side of chin.

“In May, 1880, about ten of the dark long hairs, previously operated on, appeared to have returned. Removed twenty-five from either side of chin, most of them being fine and light-colored.

“In October, the patient reported that she had been free from the capillary growth during the early part of the summer, but during the past two months a few fine hairs on either side of chin had rapidly increased in size. These were removed, and as I have recently been informed by a member of her family, there has been no subsequent appearance of the hairs.

“CASE IV.—Miss —, aged thirty-two, tall, of blonde complexion, and lymphatic temperament; health good. Applied for treatment in June, 1880, on account of long curling hairs on sides of chin and a mole on neck. She had been in the habit of pulling them every three weeks. There was no hirsuties on other portions of her body, nor were any female relatives affected similarly. Her hair, a lock of which turned gray at sixteen, appeared quite gray in front, while the back hair was of a natural brown hue. Upon her legs a singular condition had existed for two or three years. The hair upon the tibial region, instead of being normal or in excess, had almost entirely disappeared, and the existence of many follicles, either inflamed or distended by an accumulation of epidermic cells, showed plainly that the loss of hair was the result of the affection which is known as lichen

pilaris. The hair upon her chin had been growing for five years or more.

“ In June and July I removed one hundred and sixty hairs.

“ In November I removed eighty, much finer than those first operated upon.

“ In June, 1881, there were but seven to be removed.

“ In January, 1882, I removed twenty-five, which were evidently of recent development, and not a return of those previously operated upon.

“ CASE V.—Miss —, a maiden lady, aged forty-six; tall, thin, and of dark complexion; health poor. Applied for treatment in July, 1880, on account of numerous fine dark hairs upon either side of chin. She had been in the habit of cutting them close or pulling them out, and at the time of her first visit they were about half an inch in length. There was no excessive growth of hair on other portions of the body. The hairs on chin had begun to grow at eighteen years of age, and she stated that a sister and two paternal aunts suffered in very much the same way. During the week in which she remained in the city I removed five hundred of the largest hairs in six operations.

“ In September she returned to the city with apparently as luxuriant a growth as before, and no indication, at first glance, of any having been removed. Close inspection, however, showed a few red points, especially on upper lip, where hairs had evidently been destroyed. I now removed six hundred in four operations, including many finer hairs, and used a stronger current and far more care in operating than I did at first.

“ In November the number of hairs was evidently decreased, and I removed less than a hundred.

“ In June, 1881, there were but a few conspicuous hairs. I removed one hundred more, however, most of them being very fine.

“ In October there were but seven dark hairs, which I removed with twenty-five downy ones, which appeared as though they might develop and become conspicuous. A few minute cicatrices were visible upon close inspection. The patient has since written to me as follows:

“ ‘The result of the operation is very satisfactory. There are

no hairs perceptible on lip or chin, and the few scars are not noticeable.'

"CASE VI.—Mrs. ——, a married lady, aged twenty-five; quite stout, of dark complexion, and in fair health. Applied for treatment, in August, 1880, on account of long, dark, curling hairs upon either side of chin, for which she had been recently applying a depilatory. She had a luxuriant growth of hair upon the head, and said that no female relative was affected with hirsuties. The growth of hair upon her face was first noticed at eighteen years of age. She began to pull out the hairs three years ago at long intervals, but more frequently of late. She thinks that the epilation increased the growth, but not so much as did the depilatory powder which she used.

"In twelve sittings, extending through a year, I removed four hundred and fifty hairs, one-half of them being quite fine and evincing a marked tendency to develop in size. After a six months' interval, the patient writes that the operations have proved satisfactory, although the growth has not been entirely removed, and a little more must be done to make a complete cure.

"CASE VII.—Miss ——, a maiden lady of forty-six; small, thin and dark; in fair health, although of delicate appearance. Applied for treatment in October, 1880, on account of dark, curling hairs on sides of chin, and dark hairs at either end of upper lip. The growth first appeared on lip fifteen years ago. This had been treated by applications of sulphuric acid, which had lessened the growth of hair in the centre of the lip, and given it a wider appearance than the rest of the face. The hair first appeared on chin three years ago. Her mother had four or five hairy moles on her chin.

"In October, I removed one hundred and twenty-five hairs.

"In the following June, 1881, the patient returned to the city, and I removed seventy-five hairs. It must not be inferred that over one-half of the hairs upon which I first operated had returned, as in this second operation I removed many fine hairs which had been left.

"In November there were but one or two hairs at all conspicuous. These I removed, with a few more fine ones, and the pa-

tient returned to her home well pleased with the results of treatment.

“CASE VIII.—Miss ——, aged about thirty; tall, dark, and of extremely nervous temperament; health good. Applied for treatment, in January, 1881, for a slight growth of hair mostly on right side of chin, which had appeared during the preceding year. She had always noticed a tendency to a slight excess of hair upon extremities, although upon the scalp her hair was rather thin.

“At two operations, in January and February, I removed thirty-two hairs from chin and left cheek.

“In June there were but five hairs to remove.

“In February, 1882, I removed twenty-seven fine hairs, which were evidently a recent development and not a return of those previously operated upon.

“CASE IX.—Mrs. ——, a married lady, of about forty-five, with no children; tall, thin, and of dark complexion; health poor; applied for treatment in March, 1881, on account of a few fine and long hairs on chin, and a fibrous mole on right cheek, from which a few hairs sprung. She had first noticed the growth of hair about three years before and had resorted to depilatories and epilation. In March I removed forty-five hairs from the chin and inserted the needle at several points around the base of the mole, which was of the size of a split pea. In June, there was scarcely a trace of the mole and no hair on chin, save a very few fine ones which I removed. I have heard through friends of the patient since that the growth of hair was permanently removed.

“CASE X.—Mrs. ——, a young married lady of twenty-eight; of rather weak constitution, but in fair health. Applied for treatment in April, 1880, with an abundant growth of fine, soft hair on cheeks, chin, and neck, which, if allowed to grow, would undoubtedly have produced a fine, thick, soft beard. The upper lip was free from an excess of hair, and there was no tendency to hirsuties on other parts of the body. The growth of hair began at the age of fourteen, and there had been no perceptible increase during the past three or four years. For nine years she had been in the habit of pulling out the hairs at intervals of three days, and necessarily devoting a liberal amount of her

time to this procedure. Attempts had been made to destroy the hairs by hypodermic injections of carbolic acid, but with no result save the production of a few disfiguring scars. The patient stated that her mother had a remarkably fair complexion, and that no female relative suffered from hirsuties.

“ During the months of May and June I operated daily, and sometimes twice a day upon the patient’s face, and removed upward of five thousand hairs. I operated rapidly—too rapidly, as the sequel proved—and removed from one to two hundred hairs at a sitting.

“ In October, 1881, the patient came again to New York, and at first glance I could not see that very much had been accomplished. She expressed her opinion, nevertheless, that the operations of the previous year had proven quite satisfactory, inasmuch as they had lessened the growth of hair decidedly. I accordingly resumed the treatment, and with the assistance of Dr. W. S. Conover removed about one thousand hairs. This left the face much smoother and more free from hair than after the first series of operations.

“ *CASE XI.*—Miss —, aged thirty-five; of dark complexion, and in fair health; a teacher by occupation. Applied for treatment in December, 1879, with a thick and strong growth of black hairs on cheeks, lip, chin, and neck. Indeed, she would have had as perfect a beard as almost any of the women on exhibition if she had allowed the hair to grow, but for over fifteen years she had been using both a depilatory and the tweezers. Four hours at a time she was in the habit of devoting to the painful operation of removing the hair. Neither her mother nor any one of four sisters manifested any tendency to hirsuties, and the patient herself did not, except on face.

“ During the first six months of treatment I removed, with the assistance of Dr. Conover, over twenty-seven hundred hairs. During the following year about twenty-three hundred were removed by Dr. Conover and myself, making five thousand hairs in all.

The patient is still under occasional treatment for the growth of hair upon the upper lip, from which would grow a strong moustache. The removal of this is very tedious, since with a

view to the prevention of even minute scars, she only allows a dozen or more isolated hairs to grow at one time upon the lip. The left side of her face, exclusive of the upper lip, is, and has been for the past eight months, perfectly free from the objectionable growth. Upon the right side the hairs were removed with less care at first, and some fine ones have been lately removed. There have been many minute cicatrices left by the needle, but they are of little account, and the result of the prolonged treatment has been most satisfactory both to myself and to the patient.

“CASE XII.—Mrs. ——, a large, handsome lady, aged twenty-five, and apparently in perfect health; married four years and no children. Her skin was unusually fine and delicate, and with the exception of fifty-seven hairs growing upon her neck and a single mole upon right side of chin, there was no tendency to an abnormal growth of hair upon face or other portion of body.

“This patient’s skin seemed unusually sensitive, and as an exception to the rule she complained of the pain produced by the operation. Small wheals, like mosquito-bites, were produced at the points where the needle was inserted.

“These fifty-seven hairs were removed in November, 1881. Two months later she wrote me in accordance with my request, and stated that the red marks caused by the needle still lingered, ‘but so surely did the instrument do its work that the objectionable hairs seem to be permanently eradicated, *not one* having reappeared. The mole on the chin has entirely gone.’ ”

MISCELLANEOUS DISEASES TREATED BY ELECTRICITY.

As examples of the great utility of electricity in the treatment of many stubborn diseases, we reprint the following observations from the experience of Romaine J. Curtis, M. D., of Joliet, Ill., and published in the *Peoria Medical Monthly*, for June, 1882:

SKIN DISEASES—CHROMOPHYTOSIS.—Mr. ——, aged about 23, on his travels got inoculated with the matières morbi of chromophytosis. He had carried the picture about a year when

I saw him. The disease completely covered the anterior half of the trunk, and there were patches of it on his back. He was directed to use a solution of chloral, an ointment of zinc, and to bathe twice a day with use of green soap, thoroughly washing away the loosened cuticle. This treatment was of no avail, and afterwards chrysophanic acid and mercurial preparations were used. Various other medicines were prescribed, and he continued medication for about four months locally, and I gave him cod's oil and Fowler's solution. The disease would clear up in places at times, or its products with cuticle be washed off by aid of green soap, and the surface of patches look clear for a time, but would soon be covered by a fresh plant. During part of this time he wore a special covering for the diseased surface, using a new one every day, my opinion being that the clothing preserved the germs of the disease with obvious results.

I began to use galvanism in this case as a sort of dernier resort, and because I did not know what else to do. The applications were made daily, a large sponge being applied to the diseased surface and the positive pole at different places on the healthy skin. The disease began to disappear immediately. The skin along the median line became healthy first and extended outwards until the disease disappeared.

HERPES—SHINGLES.—Mr. —, aged 48 years, had complained of heart disease (intercostal neuralgia) for several years. Latterly he had an eruption of herpes zoster, covering the greater portion of left chest. He had taken iron, arsenic, cod's oil and quinine with some benefit, and was using a lotion of cologne, glycerine and lead.

The continuous galvanic current was used every other day in this case for some time without benefit. I then interrupted the current, using varieties of tension and number of cells, but the disease refused to yield until the faradic current was used, which made short work of his shingles, greatly to patient's relief, for he was impressed that should the disease extend to the right side of his spine his life would soon terminate.

ECZEMA.—Miss —, aged 18 years, had eczema, covering left side of nose and portion of cheek, of four years' duration. She had been through the regular course of zinc, arsenic, iron,

quinine, cod's oil, etc., etc., and had "tried Homœopathy," which was found wanting. No medicine was used in the treatment of this case, but the galvanic current effected a cure in four months. The poles were applied indifferently, one being over the eruption, and the other sometimes behind the ear and sometimes on the cervical spine. After each *seance* there would be for a few hours some swelling and increased redness of the eczematous skin.

ACNE.—Mr. ——, aged 20 years, had been disfigured by acne of the face since his fifteenth year. He had a long history of mortification of spirit, sulphur baths, zinc ointment and Fowler's solution. The treatment of galvanism was continued at irregular intervals for six months. Each application had the effect of so reddening the surface where the sponge was applied to the face, that the patient would take his dose only late in the evening—a sample of pride under great difficulties. He was cured, however, without lotion, ointment or medicine.

AMAUROSIS.—R. M., aged 23 years, worked in the rail mills, and was subject to extreme degrees of temperature during the "heats." He gradually became blind—could see the largest test type with indistinctness only at a few inches. He had naso-pharyngeal catarrh and sequent vomiting, steel scales, and carbonaceous matter was always present in the nasal and pharyngeal cavities, where they could be seen by the laryngoscope.

The patient was obliged to stop work, and was treated for his catarrh by sprays, and his amaurosis by galvanism for six months, when he was discharged cured. The current from five or six cells was generally used, and the positive pole applied over the eye and the other over the mastoid. The current was tempered by the rheostat, so that during its passage faint flashes could be seen. In this case the retina of the eye was anaemic.

AMENORRHœA.—Miss ——, aged 26 years, had been a teacher in public schools for eight years. During past two years she had suspension of the menstrual function and occasional attacks of asthma. She was plethoric; of good appearance physi-

cally, and complained of no local pain or other sensory disturbance. I suppose, in the light of modern pathology, her disease would be called neurasthenia, of some set of motor or gland nerves. She declined a pelvic examination, and I recommended galvanism for the amenorrhœa. The current was passed from the lumbar region through to ovaries. The *seances* were held twice a week, and during the sixth week of treatment the menses were restored, which had the effect of stopping the asthma.

LEAD POISONING.—Mrs. ——, aged 23, married four years, no children; was a fashionable person of most intense personal vanity. She was a perfect specimen of neurasthenia; the antecedents and sequences of this disease were all there. She was even subject to hay fever. She had uterine disease, and had been subject to the silver treatment for a year or two by an eminent gynæcologist of Buffalo. She had “wrist drop,” which was very noticeable when I made my first visit, and I suspected the cause of her abdominal pains; which suspicion was confirmed by an inquiry in this direction and the exhibition by her husband of her large collection of hair washes and cosmetics, all of which contained lead. The patient had been bed-ridden for several months. Her cosmetics were disposed of; iodide of potash was given, and general faradism employed daily for a month, when she recovered from her neurasthenia, and resumed her social standing without the aid of lead.

LUMBAGO.—Mr. ——, a carpenter, strained his back by working on a cornice, and was placed *hors de combat* by pain in his back when he attempted to move. His appearance and movements were such as are always exhibited by the lame back. He came to the office three times, and a current of sixty cells was passed through the painful part, about fifteen minutes each time. The relief was marked at each dose of the remedy and the cure prompt.

Mr. ——, aged about 40 years, a rheumatic subject, was brought to my office and carried in groaning from pain, which was referred to the lumbar region. This case illustrated the exception which proves all rules. I applied the galvanic current,

with very large quantity, with greatly lessened intensity, fully expecting to stop his pain and groaning in a few minutes. To my surprise he complained of an increase of the pain, and in a few minutes fainted. When he recovered he refused to allow further galvanization and would not take medicine. He was taken home and a physician sent for, who gave him morphia, and sympathized with him by remarking that "electricity was a humbug anyhow"—an opinion to which the patient gave his free assent, and I suppose they are both of the same opinion still, and that each of them knows as much about it as both, and both of them as much as either.

RHEUMATISM.—Mr. ——, aged about 30 years, a laborer, native of England, had muscular rheumatism of the right leg. The muscles were tender, swollen and paretic, and he went and came on crutches. There was no evidence of venereal disease. The patient had a gouty ancestry, and the exciting cause of his own disease was working in a wet ditch. He had suffered from this disorder for several months, had taken several medicines, and received some benefit from iodide and colchicum. He was sent to me by a physician who was somewhat undecided about the humbug of electricity, and was disposed to investigate. The patient's foot and leg and the negative pole were put into a vessel of warm water, the positive pole being applied to the leg higher up. This treatment was continued daily for two weeks, when patient was discharged cured.

INDURATIONS.—Mr. ——, aged about 60 years, had acute rheumatism, which lasted two months. He was treated by salicylate of soda, which failed, as he could not take it without insanity, and he was brought through by the alkaline treatment. On subsidence of the acute symptoms the tendons of various muscles in upper and lower extremities were subject to indurations, which showed no disposition to absorb. He was given iodide and colchicum without much benefit, the enlargement of the hamstring tendons and tendons of ankle joints and wrists being thick and painful. He remained without much improvement for two months, when he was brought daily to the office for galvanic treatment. The different indurations were treated separately by passing the galvanic current through them. The treatment was continued

daily and every third day for three months, when the indurations of the tendons were absorbed and the normal functions restored.

Mr. —, aged 37 years, a merchant, sprained his ankle severely, which injury was followed by an induration of the tendo Achilles. The tendon in lower half of its length was more than double its natural thickness. This deformity was treated every other day for a month with the negative pole attached to a roller electrode, thus combining the electrolytic effects with massage, a very convenient and efficient method. The tendon was restored to its morphological and physiological integrity.

NÆVI MATERNI.—Miss —, aged 12, had a port wine mark on her left cheek about the size of a dime. The natural beauty of the anatomical deformity was somewhat deteriorated by several applications of some sort of caustic, which had, however, not removed it. Three fine needles were inserted through the nævus, carrying the negative pole, and the positive was placed near by on the sound skin. The current from the cells was used about five minutes. In a week the operation was repeated, and the nævus disappeared.

Miss —, aged 16, had a prominent, raised, purple nævus on the left cheek; a physician had attempted its removal with a faradic machine, and afterwards applied caustic, and then suggested cutting it out. In this case four electrolytic applications of galvanism were used, which removed the mark.

Mrs. —, by some slip of the embryonic tissues, had a spot on her left upper lip about half an inch in diameter, from which sprang a vigorous growth of hair. I undertook to destroy the hair follicles in this case, and succeeded after the following method: A small needle (negative pole) was pushed into the follicle beside the hair and held in position about five minutes, the lady holding the other electrode in her hand. Five or six hairs were thus abused at each *seance* until the whole crop was removed. This is an operation which is tedious and very useless, unless there is considerable beauty behind the unnatural growth. It is, however, a very satisfactory operation for the patient.

LOCAL ATROPHY.—Mr. — received an injury to the shoul-

der in a railroad accident. There was nothing of dislocation or fracture, but the injury was followed by atrophy of the deltoid muscle. There was no antecedent paralysis; but the muscle, what was left of it, would contract by volitional stimulus, though there was not force enough to raise the arm from the body to a level with the shoulder. The faradic current was used in this case with the roller electrode for three months, the applications being made two or three times a week, when the muscle was restored in form and function.

Mr. —, about a year before I saw him, was thrown from his horse, striking on the back of his right shoulder. The arm was useless for several months from pain and paresis. On examination the spine of the scapula was his most prominent morphological feature, by reason of the atrophy of the muscles above and below. Electricity, faradic and interrupted galvanic, with massage, were used for this deformity for a year with the result of making restoration, which, though not complete, was serviceable.

Mr. —, aged 23 years, had typhoid fever, the duration of which was six weeks. During convalescence he over-fed and was relapsed for nearly two months. He finally recovered from this illness, and rapidly gained his average weight of 170 pounds; but three months afterwards his gait was ataxic, for the reason that he had lost sensation of his legs and feet. There were no pains in legs, nor other evidence of tabes, except diminished sensation. The faradic current was used in this case, and fully restored the sensation of legs in a month's time. The applications were made daily by placing the feet in a bath containing one pole, while the other was applied on the extremities above—to the spine or held in the hands.

THE WRONG CURRENT.

From the proceedings of the New York Medical Society, and published in the *Medical Record*, we glean the following important items, which entirely agreed with our own observations.

Dr. Rockwell thought that the mistake could be best pointed out by reporting a few illustrative cases, from a score or more that might be narrated:

Mrs. —, an opera singer thirty years of age, was sent to him by Dr. J. B. Read. Several months before, while singing in public, she was suddenly attacked with left *facial* paralysis. The eye refused to close; she subsequently suffered from severe cephalgia and marked vertigo. The physician to whom the patient first applied prescribed electricity, used it a few times, and then directed her to buy a small faradic apparatus, and apply the current along the course of the affected nerve. This was done faithfully for many weeks, but with negative results. On examination, no response, as might have been expected, could be obtained by the use of the faradic current. Galvanism, however, at once produced faint contractions, and three weeks after the proper treatment was begun, farado-muscular contractility returned, and recovery to a good extent had taken place.

CASE II.—A boy, four years of age, suffered from cerebro-spinal meningitis, which was followed by *complete paralysis of the right leg*. The patient was sent to Dr. Rockwell by Dr. Chauveau. Before Dr. Chauveau saw him a physician had recommended the faradic current, and it had been used faithfully, but without benefit. On examination there was no response to faradism, and only slight reaction to galvanism. Under the systematic use of the galvanic current, however, improvement began, and farado-muscular contractility was finally restored. The improvement in the power of locomotion was coincident with that of the electro-muscular contractility. Dr. Rockwell thought there could be no doubt that in both these cases the failure to correctly differentiate in the selection of the method of treatment not only interfered with the rapidity of recovery, but in one instance, at least, might be the cause of some permanent disability.

ELECTRICAL CONDITIONS OF THE MUSCLES IN FACIAL PARALYSIS.—In facial paralysis the farado-muscular contractility is either normal or decreased, but the galvano-muscular contractility may in addition, in certain cases, be *increased*, while the reaction to the faradic current in the same cases is either wanting or very much diminished. In these cases the galvanic current must be used with increasing strength, at each sitting, in order to keep up the vigor of the muscular contractions when galvano-muscu-

lar contractility is reduced to normal, or sometimes before faradomuscular contractility becomes manifest, and a rapid recovery usually follows.

Dr. E. C. Seguin said, with regard to the use of *the actual cautery*, that his experience was very much in accord with that given by Dr. Rockwell. Occasionally remarkable results were obtained from one or two applications. He had found it very serviceable in exceedingly painful cases, as well as those of the character described.

With regard to the simplicity and painlessness of the application, he entirely agreed with Dr. R. Sometimes considerable argument was necessary to induce a patient to submit to the first application, but he had not had any trouble whatever concerning the second operation; indeed most patients returned of their own accord and asked for the use of the cautery. The question of the *utility of the two electric currents* he regarded as a very important one. But he thought it possible that in one of Dr. Rockwell's cases at least, if it had been left to nature, the patient might have recovered without electricity. It was probably a case of paralysis from lesion of the nerve, whether from superficial pressure or from reflex action upon the nucleus of the nerve was uncertain, but there were good reasons, from clinical history and from electrical reactions, to assimilate it with cases of ordinary nerve injury. In such cases he thought there was a fatality in the degeneration and regeneration of the nerve, and he doubted very much whether measures commonly used had greatly to do with recovery. The process of regeneration is much slower than that of degeneration, but it takes place with a great deal of certainty, and in a majority of cases of facial paralysis the recovery was through the process of repair of the nerve, and the consequent repair of the muscular tissue. He agreed entirely with Dr. Rockwell that the faradic current was next to useless for several weeks or months, and he also doubted whether galvanic applications had much to do with recovery. The changes in the electrical and nutritive state of the muscular fibres produced by the application might do something toward keeping up the nutrition of the muscle, and preserve it in a condition fit for action when the nerve had improved. He did not, however, believe that electrical currents could hasten cell growths.

The inutility of the faradic current in facial paralysis was a point worth directing attention to, and undoubtedly ignorance with reference to it had many times brought discredit upon the profession.

Dr. Janeway said he had long believed that the great value of the galvanic current in facial paralysis was two-fold.

In the first place, it gave a means of making a prognosis with regard to the probable time required for recovery. If the faradic reaction was destroyed and the galvanic preserved, the great probabilities were that it would require more than two months for recovery to occur, probably from three to six months.

In the second place, it was valuable in keeping up the nutrition of the muscles. The faradic current he regarded as totally useless in these cases, to say the least. Dr. Janeway then referred to a case of *facial paralysis* of the peripheral type, due to exposure to cold and occurring in a child eight months old.

With reference to the actual cautery, he had to admit the same doubt that Dr. Seguin had expressed concerning the utility of the galvanic current. He was sometimes in great doubt as to whether the good results were due to the mental effect or to the actual influence of the cautery. It was very frequently difficult to separate effects produced by an agent itself from those produced by the imagination.

In connection with the sequelæ of cerebro-spinal meningitis he had used, with benefit, the actual cautery along the side of the spine, in addition to blistering in the upper cervical and occipital region.

Dr. Rockwell said he was very nearly in accord with the views expressed by Dr. Janeway and Dr. Seguin concerning the use of the two electric currents in the peripheral form of facial paralysis. The aid afforded to nutrition by the use of the galvanic current was very important. His chief object in reporting the cases was to direct attention to the necessity of correctly differentiating between the two currents.

Dr. Putzel referred to a case in which the faradic current used in facial paralysis produced actual harm. The paralysis was due to exposure to cold, and the degenerative reaction was well marked. The result was twitchings, followed by contracture, which was persistent.

Dr. Seguin wished to put upon record his experience with reference to an undescribed sequel of facial paralysis due to cold, namely, a condition of marked twitchings corresponding precisely with post-hemiplegic chorea. Within the last eight years he had seen four or five recovered cases of facial paralysis in which, during the period of actual recovery, there occurred clonic twitchings, short, lightning-like jerks of muscles formerly paralyzed; and this phenomenon occurred without mislaid treatment or contracture.

Dr. Putzel thought there was a difference between this condition and post-hemiplegic chorea, because in the latter there was a slow movement of one muscular fiber after another, while in these cases the muscle twitches as a whole and then subsides.

Dr. Seguin remarked that the point brought out by Dr. Putzel was an interesting one. He had shown to his class a graded series of cases in which there were post-paralytic movements, and had been able to show two or three varieties in a single lecture. He had classified the cases into (1) those in which athetoid movements occurred, (2) those in which the movements were more marked, and (3) the ataxic cases. The shading off from one condition to the other is sometimes exceedingly delicate.

Dr. Roberts, as illustrating how widespread the opinion was that the differentiating of the two currents was not a matter of much practical importance, said that not long since he heard a college professor explain to his class the feasibility of treating all cases with an ordinary faradie battery.

Dr. Birdsall referred to two cases of facial paralysis of peripheral origin, in which there were contracture after a number of months and muscular movements of the quick variety. He had used the galvanic current in facial paralysis with the result of giving the patient relief from the feeling of tension.

ELECTRO-DIAGNOSIS.

On pages 34, 35 and 37, electricity is referred to as a means of diagnosis. In our practice, this agent is utilized as an aid in diagnosing conditions of hyperesthesia; in anaesthesia; in paral-

ytic affections; in detecting and exposing malingerers; and for deciding whether a person is really dead or only apparently so.

As in the use of electricity under every other circumstance, in order to use it with profit in diagnosis, we must know its usual effects when applied to different parts of the body in health. Being familiar with the sensitiveness of certain parts of the body to the electric current, and the comparative insensibility of other parts, we are qualified to employ this agent for the purposes named. For testing the condition of sensation we generally resort to the faradic current, but in some cases the galvanic current is employed. Let a patient hold the electrode attached to the positive pole of a faradic machine in one of his hands, while we place the electrode of the negative pole upon a certain part of his body and observe the result. Is the sensation, as experienced by the patient, painful, and the part more sensitive than common, or is the sensibility lessened? Do the muscles contract as they usually do when we apply the faradic current, or is the part in a comparatively passive condition? After we have satisfied ourselves upon these points, we remove the negative electrode, and immediately place it upon a corresponding part of the body and compare the results. It is plainly seen that we may, by this simple procedure, learn something about the condition of parts and organs. In applying the faradic current for testing the condition of sensation, we should always keep in mind the fact that certain parts of the body are exceedingly sensitive to electricity, while strong currents are tolerated by other parts without complaint. The top, front and sides of the head are very sensitive; and the eye and ear also. The hands are more sensitive than the feet. But corresponding parts should exhibit no disparity.

In any examination, if we find that the usual feeling of tingling or numbness resulting from the faradic current in health is very much diminished, or is entirely absent upon the application of the negative pole of a faradic machine, we know that anaesthesia, analgesia, loss of sense of pain, paralysis of sensation exists; whether temporary or permanent is to be determined. On the other hand, if we find the part unusually sensitive, the current producing uncommonly painful sensations, we

know that hyperæsthesia exists, and that a certain course of treatment, quite different from that to be pursued in the case of anaesthesia, must be adopted. Acute affections, whether of nerves, nerve centres, or other tissues, are distinguished from chronic diseases by the abnormal sensitiveness of the parts to the faradic current. If we apply the negative pole of a faradic machine over the region of the liver in acute hepatitis, the patient complains greatly of pain, and says the current is too strong. On the other hand, if we apply the same current over the region of an enlarged liver or spleen resulting from repeated attacks of malarial fever, we find that the patient can tolerate all the power of our battery, and complain of nothing except a slight pricking sensation on the surface.

Again, it is a well attested fact that if the positive pole of a galvanic (not faradic) battery is placed on the upper and back part of the head, and the negative pole is held in the hand of the subject or placed over his stomach, a distinct metallic taste is perceived by him; this results in conditions of health. Now, if a patient observes this metallic taste when the positive pole of a galvanic battery is being passed along the spine anywhere, the negative remote from the head, it is evidence of an irritable condition of that portion of the cord, for it is not usual for this taste to be perceived in health, except when one pole is applied to the head.

Another important point: If, while a patient has hold of one of the poles of a galvanic battery, we rapidly apply and remove the electrode attached to the other pole of the battery to the forehead, just above the eye, the patient will see distinct flashes of light. Now it sometimes happens that considerable disparity in the eyes exists, regarding these flashes of light, or the flashes are exceedingly vivid, even unpleasant to the patient when the mildest current is used. In other cases strong currents are required to enable the patient to observe these flashes, and in some cases they cannot be seen, no matter if we use a current as strong as the patient can otherwise bear. In each of these cases we are materially aided in making out a diagnosis. And the tests are so simple that anybody can make them; only a little care is required that the currents may not be too strong when used about the head and face. Quite a strong current can

be applied to the spine below the cervical vertebra, but if tender spots are traversed, the patient will know it. In some cases of spinal irritation, and locomotor ataxia, not only does the patient perceive a metallic taste in the mouth while one pole is held in the hand and the other applied to the spine, but he sees distinct flashes of light, just as though one of the poles was being applied about the forehead. These are not only profitable experiments, but they are exceedingly entertaining to those who are interested in the careful study of disease, its manifestations and treatment.

One of the most important points decided by electricity in diagnosis is that relating to central and peripheral paralysis. This is beautifully illustrated in many cases, but we meet with more examples in cases of facial paralysis than in any other form. Where the disease is central, originating within the cranium or at the root of the nerve at the spinal cord, the faradic current, when applied to the paralyzed parts, produces the usual muscular contractions observed in health. But if the impairment or injury is located somewhere along the trunk of the nerve, outside of the cranium or remote from the cord, or in that part of the nerve passing through the bone, then the faradic current will not excite muscular contraction, while the galvanic current, applied in the same manner, will produce muscular contraction even more violent in some cases than occurs in health. This is an important item for this reason : Where we know a paralysis is of peripheral origin, the prospect of cure is more flattering ; whereas if we are certain the disease is within the cranium or in the cord, we are apprehensive at least, if we have any hope at all. These hints will enable anybody to make satisfactory tests in many cases, and, if carefully conducted, these examinations may lead to correct principles and proper plans of treatment..

MALINGERERS.—HOW TO DETECT THEM.

It occasionally happens that we are called upon to testify whether a man is really sick or is merely pretending for fraudulent purposes. Where a patient claims to be suffering from

paralysis of a limb, or any part of the body, we may resort to electrization, and if corresponding parts show a marked disparity in contractility, it is fair to suspect that the patient is correct and honest. If, on the other hand, he cannot resist the natural effects of the electric currents, and we can discover no diminution or exaltation in the muscular contractility, then we may suspicion deception. Dr. Julius Althaus, in his great work on Electricity, details an exceedingly interesting case, and in this connection we give the quotation in full:

“In November, 1871, I was consulted by the secretary of a working-men’s benefit society with regard to the case of one of the society’s members, who professed to have lost the use of his left arm in consequence of an accident which he had had three years previously. According to the society’s rules, the sum of 100*l.* is paid to members who are permanently incapacitated for work by disease or accident. The patient had had a fall from a considerable height, and asserted that ever since he had been unable to use his arm. He had been admitted into a provincial hospital, where he remained for three months, and where (to use his own words) ‘the surgeon tried as hard as he could to cure him,’ but failed. In course of time the man, who was known not to have done any work since the occurrence of the accident, applied to his society for the 100*l.* owing to him; and I was then requested to give an opinion whether the patient was permanently or only temporarily disabled.

“The claimant was a tall, powerful man of determined countenance, and evidently considerable force of will. He professed to be unable to undress himself, and had therefore to be assisted when the helpless limb was bared for examination. I found that the temperature and the bulk of the left arm were in all its parts quite equal to those of the right. The limb was held in full extension, and drawn to the body, while the fingers were somewhat tightly flexed. On endeavoring to flex the fore-arm and to supinate the hand, considerable resistance was encountered; and, when additional force was used for effecting this purpose, the patient called out with pain, and said he could not bear the manipulation.

“Seeing this condition of the limb, only three pathological conditions could be suspected, viz., paralysis with contraction, ankylosis, or dislocation—provided always that the patient was sincere. In peripheral paralysis, owing to injury of the motor nerves of the part—which is the only form of paralysis that could be thought of in this case—there is rarely any great amount of contraction, since the paralyzed limbs are mostly

found flabby; and if the case be of long standing, the muscles are wasted, and the temperature is considerably diminished. But as these clinical signs, although of value, are yet not invariably present, I employed a test which gives absolutely decisive results in such cases, and enables us at a glance to decide the presence or absence of peripheral paralysis—viz., faradisation. It has been shown by the concurrent testimony of all recent observers who have investigated this subject, that, in peripheral paralysis caused by injury to the motor nerves, the muscles animated by those nerves lose their *faradic* excitability, while their *galvanic* excitability may be preserved, or, under certain circumstances even increased. If, therefore, in the present case, the deltoid, triceps, biceps, and the other muscles of the useless limb, could be made to respond by contraction to the faradic current, it would be rendered evident that there was no paralysis owing to injury of the brachial plexus or any of its branches.

“On using faradisation, I found that all the muscles of the arm and hand responded readily to the current by contraction of their fibres; yet, curiously enough, the arm of the patient did not execute those movements which are generally produced by such an application. Something evidently resisted the displacement of the bones; and when I looked at the powerful determination visibly expressed in every feature of the patient’s face, his hard stare, his contracted brow and lips, I could not help feeling suspicious that this something might be the patient’s own volition. The influence of faradisation being irresistible, if a sufficiently strong current be used, I increased the power with which I acted, in order to overcome any possible resistance on the part of the patient; but the latter called out so lustily, saying that he could not bear the pain, that I was obliged to desist. Enough, however, had been ascertained for enabling me to eliminate one of the three pathological conditions which could give rise to the complaint of the patient.

“I now informed the secretary that, although I was satisfied myself that there was no paralysis, yet it was impossible for me to give a certificate concerning the exact nature of the affection from which the patient suffered, unless he were previously placed under the influence of an anæsthetic. All parties having consented that this should be done, I procured the assistance of Mr. Clover, who on the following day administered nitrous oxide gas to the patient. The latter was rapidly rendered insensible; and I could now freely move the arm in all directions, there being neither dislocation nor ankylosis. As soon as this was ascertained the influence of the anæsthetic was withdrawn; and the patient, who recovered himself in a few moments, was informed that his case was not nearly so bad as he had imagined, and that

he would certainly recover the use of the arm under proper treatment. I gave a certificate to the effect that the patient suffered from a painful affection of the shoulder-joint, which would yield rapidly to a subcutaneous injection of morphia or a judicious use of galvanism; and that there was neither paralysis, nor dislocation, nor ankylosis, seriously to interfere with the use of the extremity. The claim was therefore not allowed."

Ordinary faradic machines and galvanic batteries may be used for these purposes, and a mere novice can apply them. The observations should be carefully made, however, and the tests should be thorough.

TESTING FOR LIFE OR DEATH WITH ELECTRICITY.

An estimable widow lady, of this city, lost her only son. He died from cerebro-spinal meningitis, after a few hours' sickness. He died so suddenly, and looked so natural and life-like after he was laid out, that his mother could not believe her only son was dead. The attending physician was ready to certify to his death, and the undertaker felt quite sure that life was extinct. All this did not satisfy the mother, and she demanded that the most critical test should be made, that she might be satisfied her son was really dead before she buried him. The very thought of laying him away with doubts in her mind, thinking may be he might be buried alive, when only apparently dead, nearly distracted her. A thorough electrical test established the condition of death to a certainty. Now, this was a case very similar to others that anybody may see, and we should always be ready to give such people satisfaction, if possible. And it has occasionally happened that people have been buried alive. They might have lived for years had they been left alone or properly cared for. Knowing these things to be so, it is not to be wondered at that tests for life and death are sometimes demanded. The following quotations from Althaus may serve to add something to the interest of this subject:

"Rachel, the celebrated French actress, had been eleven hours in her coffin when she awoke from her trance, and lived for some hours afterwards. Dr. Josat states that in France about thirty or forty people are annually buried alive. On February 27,

1866, a debate on the subject took place in the French senate. M. de la Gueronnière said that, to his knowledge, when graves had been removed in old burial-places, 'skeletons had been found in their coffins in all sorts of positions. Their limbs, horribly distorted, betrayed the last revolt of life, the agony of a terrible situation, of which the living had heard neither a cry nor even the last sigh!' Cardinal Donnet narrated that he had saved two people from being buried alive, and that such an accident very nearly occurred to himself:

'In 1826, a young priest, while standing in the pulpit, suddenly fell down, and was pronounced to be dead by the doctor who examined him. He heard the funeral chant, the *De Profundis*, recited at his bedside, and all preparations for his burial, without being able to move or to pronounce a single word. A providential accident allowed him to come out of his trance in time. To-day, having become the Cardinal Donnet, he requests the powers that be not only to take care that the legal forms concerning burials should be strictly observed, but also to introduce new tests in order to prevent irreparable disaster.'"

"Rosenthal has recorded an interesting case of trance in a hysterical woman, in which a country practitioner had declared death to have ensued, as a looking-glass held to the mouth did not show any moisture, and melted sealing-wax dropped on the skin caused no reflex movements. Rosenthal, who was accidentally present, found the skin pale and cold, the pupils contracted and insensible to light, the upper and lower extremities relaxed, the heart's impulse and the radial pulse imperceptible. Auscultation, however, showed a feeble, dull, and intermittent sound in the cardiac region. No respiratory murmurs were audible. All the muscles of the face and extremities responded well to the faradic current. Although the patient had been apparently dead for thirty-two hours, he thereupon informed the relations that it was only a trance, and recommended that attempts at resuscitation should be perseveringly followed. On the following day he received a telegram to say that the patient awoke spontaneously twelve hours afterwards, and gradually recovered her speech and movements. Four months afterwards the patient called upon him, and informed him that she knew nothing of the commencement of her attack of lethargy; that she had afterwards heard the people about her talk of her, but had been utterly unable to give the slightest sign of life. Two years afterwards, she was still alive and tolerably well. Rosenthal appropriately likens this condition to that of 'nightmare,' where, in spite of distressing sensations, the dreamer is unable to call for help or to make any movements which might save him from some imaginary impending danger."

There is no sign of death, in doubtful cases, so decisive as the faradization test. It indicates life or death with absolute certainty. The application of electricity in these tests is called "Electro-bioscopy." Any ordinary faradic apparatus is sufficient for this purpose. Gaiffe's pocket instrument is very good.

The facts regarding the application of faradization in these tests are so well recorded by Crimotel and Rosenthal that we quote their observations verbatim:

"1. Death is certain when the muscles have entirely lost their faradic contractility; on the contrary, life is probably extant when this property is preserved in its full integrity. A perceptible diminution of it is a sign that life has ceased a short time ago. In newly born infants Crimotel found the contractility to continue from fifteen to sixty minutes after the heart had ceased to beat, but it was diminishing progressively all that time. In children and adults the contractility persists longer than in infants, and the length of its post-mortem continuance varies according to the nature of the disease and the kind of death; but it never continues as long as three hours after death. In some cases of cholera it was found to be entirely gone half an hour after life had become extinct; the same was observed after more or less prolonged diseases which had gradually exhausted the vital forces, such as phthisis, typhoid fever, etc. In all cases, however, in which the faradic contractility has been unimpaired up to the last moment of life, it was seen to become perceptibly modified soon after the heart had ceased to beat. The most powerful current did then no longer produce those strong movements of flexion and extension which were caused during life; on the contrary, the movements were limited, the contractions enfeebled, and at last only slight vibrations could be observed which were in their turn followed by complete absence of any response whatever.

"2. No disease, nor any kind of asphyxia or poisoning, will during life abolish the faradic contractility *in all the muscles* of the body. Majendie and Royer have shown that in dogs, poisoned by carbonic acid and sulphuretted hydrogen, the contractility persisted for some time after death. Claude Bernard has found the same to be the case with woorali, strychnia, and other poisons. It is true that in certain forms of paralysis faradic contractility may be lost, but such forms of paralysis never affect all the muscles of the body. In muscular atrophy, with or without fatty degeneration, farado-puncture would produce contractions, and the diaphragm would respond to faradisation of the phrenic nerve.

“ 3. A notable diminution of faradic contractility in the whole muscular system is a sign of death. In apparent death, on the contrary, it is sometimes augmented. If in about twenty minutes after the occurrence of apparent death no diminution occurs, life is probably still extant.

“ 4. ‘Electro-bioscopy’ should be recommended in all doubtful cases, and anyhow where the relations of the deceased should desire it to be employed ; it being a radical means for preventing premature interment.

“ 5. ‘The faradic test becomes indispensable in the drowned, the asphyxiated, etc., and should be imperatively required of those practitioners who have to certify in cases of sudden death. When there are several victims—as from shipwreck, railway accidents, etc.—it would have the additional advantage of enabling the attendants to distinguish at once the dead from the living. The doctors would therefore be in a position not to lose precious time with the dead, but might concentrate their attention on those who would still be benefited by it.

In newly-born infants, again, who do not give signs of life, ‘electro-bioscopy’ would be of the utmost value.

“ 6. The faradic test will allow the practitioner to certify, if a remainder of contractility be still discovered, that death has taken place within three hours of the observation.

“ 7. When several persons have perished by the same accident, the test may permit, in certain cases, to decide in which order they have ceased to live.

“ 8. In the hands of the practitioner the test becomes at the same time one of the most powerful, prompt and effective means for resuscitating persons who have apparently ceased to live.

Finally, it may allow the authorities to accelerate the burial of the dead, or any operation to be performed with deceased persons ; such as embalming, post-mortem examination, etc., in case it should be inconvenient to wait for the ordinary delay.”

“ Rosenthal found that the post-mortem electric excitability disappears more rapidly after death from chronic than from acute disease ; that it remains longer in well-nourished than in wasted bodies, and that it is generally extinguished in from ninety minutes to three hours. In one case, when all trace of excitability, even to galvano- and farado- puncture by a most powerful current, had disappeared, the temperature in the rectum was still 99.4°, and the joints were still quite flexible ; yet death could be diagnosed with absolute certainty. In amputated limbs he found faradic as well as galvanic excitability well preserved during the first hour after the operation ; ninety minutes afterwards only electro-puncture could show traces of it, and in

two hours after no response whatever took place. In a case of drowning, a feeble faradic current produced good contractions within the first hour; after that it was necessary to increase the power of the current in order to cause contractions of the same strength as before. In two and a half hours, only the orbiculares of the eye and the mouth, and the flexors of the fore-arm, answered to the maximum power of the apparatus. In three hours and a quarter electric excitability had everywhere vanished. Rigor mortis only appeared after five hours in the hand, and after six hours in the elbow."

These are interesting observations, and the principles and tests are so simple that any country physician should be able and ready to put them into practice. All that is necessary is to apply the poles of the battery to different parts of the body, as already suggested in the cases quoted from Althaus, and as recorded by Crimotel and Rosenthal. Where small faradic instruments are not regarded as sufficient, the larger machines may be brought into service.

ELECTRICITY IN ASPHYXIA.

In cases where chloroform has been given to excess, or where the effects have been unexpectedly depressing, and death is threatened; where an overdose of opium or morphine has been taken, or given by mistake; and in all cases of suspended animation, from the effects of cold, fright or drowning, electricity, in some form, is one of the best measures to which we can resort. In most cases a powerful faradic current should be used. The positive pole should be placed upon the neck, over the phrenic nerve, and the negative over the diaphragm, which corresponds in position with the seventh intercostal space. The positive electrode upon the neck should be gently moved up and down over the cervical vertebra, and the negative pole should be moved quite frequently, from one side to the other, over the region of the diaphragm. The faradization should be continued in persistent cases for hours, until the face redds, the pulse becomes perceptible at the wrist, and the patient breathes. As long as there is any response, or while muscular contraction can be produced in any part of the body by the faradic current, there is hope. It is astonishing how

promptly some patients are revived by this method, and nobody engaged in the practice of medicine should neglect to be provided with the necessary apparatus for this mode of treatment, for many lives may be saved by it. Even where electricity alone might be insufficient, it may revive the patient temporarily, and thus afford opportunity for administering appropriate stimulants by the mouth. This has been the result in numerous cases recorded in our exchanges, and it should be well remembered.

Some interesting cases are reported by Althaus which we here detail, because they are interesting and instructive :

“A servant-girl, aged 27, was found in her bed early one morning, asphyxiated by charcoal-fumes. Counter-irritation of the skin proved unavailing in inducing respiration; and when Ziemssen was called in, the pulse and respiration were almost imperceptible: the skin was getting pale, the temperature of the extremities low, and the râles in the trachea more marked. The phrenic nerves were now rhythmically faradised, when the chest was seen to expand, the girl began to cough, the cheeks showed a faint flush, and the extremities became warmer. Faradisation was continued, with short interruptions, for two hours, when respiration was fairly re-established. Eleven hours afterwards respiration was regular, and the patient was quite well the next day.

“Friedberg has been equally successful in a case of asphyxia in a boy aged 4, who was placed under the influence of chloroform in order to have a cyst of the eyelid removed. After a few inhalations the pulse suddenly became small, the face livid, the eye glassy, the limbs relaxed; one short râle was heard, after which respiration ceased. Cold water was rapidly thrown on the face and chest, ammonia held under the nose, and the larynx tickled with a sponge. After this had been done for two or three minutes, the pulse became imperceptible, the complexion pale, the lower jaw dropped, the expression of the face was cadaveric, and the pupils dilated. Artificial respiration by methodical compression of the abdomen was then resorted to for three minutes, but likewise without any result. Dr. Friedberg now faradised the diaphragm by putting one electrode to the phrenic on the neck, and the other into the seventh intercostal space, for one second at a time. After ten such applications, the first inspiration took place; faradisation was then discontinued, and a second and third inspiration were seen. After the third, the radial pulse re-appeared, and further methodical compression of the abdomen was now sufficient for re-establishing respiration and the heart’s action. In twenty minutes the child had fairly recovered. The

operation was then performed, and the little patient slept for an hour; after which he appeared perfectly well, and no further effect of the chloroform was noticed.

“Ziemssen has used faradisation of the phrenic nerves in four other cases successfully; the asphyxia being due to poisoning with carburetted hydrogen gas, charcoal-fumes, and to freezing after alcoholic intoxication. In five other cases which came under the care of the same observer, the proceeding failed to do good. Oppenheimer has been unsuccessful in a case of opium-poisoning, although he continued faradisation for three hours. Mosler and Möller have likewise published unsuccessful cases. Pernice has used faradisation in five cases of apparent death in newly-born infants; in two of these the result was *nil*, while in three life was restored.

“Dr. Hardie, of Manchester, has restored life in two similar cases by faradisation of the phrenic nerve. One was that of a boy aged 10, who was operated upon for a cyst on the shoulder-blade, and who during the operation suddenly ceased to breathe, nor could the pulse be felt. He had a livid appearance, which soon passed off into pallor. Cold affusion and artificial respiration having been tried and failed, the aspect of the patient seemed very hopeless. Faradisation of the phrenic was now practiced by Dr. Gumpert, upon which slight and very superficial respiration occurred, and the heart's movements became visible. In three-quarters of an hour the child was out of danger.

“In another case, that of a woman aged 42, who was operated upon for secondary cancerous deposit in the axillary glands, Dr. Hardie was dissecting out the glands when the respiratory movements ceased without previous stertor or other warning; the patient's face assumed a death-like pallor with slight lividity; the eyes were staring and the pupils widely dilated; the pulse immediately afterwards became imperceptible. The tongue was at once drawn out, but without response on the side of the respiration. The electrodes of a volta-faradic apparatus were applied to the root of the neck over the phrenic nerves (cold affusion and a few acts of compression of the chest having in the meantime failed to induce respiration). For a time there was no response, and the patient's condition seemed hopeless. At length, however, a short gasp came, then others, which soon became deeper and regular; the pulse became perceptible, the color returned to the face, and the pupils contracted. Dr. Hardie considers that the boy was dead three minutes, and the woman one; and he recommends every practitioner to make a faradic apparatus the invariable companion of his chloroform bottle.

"Mr. Green, of Bristol, has recorded seven cases of syncope from chloroform, of which two died and five recovered. In these latter magneto-faradism was instantly applied on the appearance of danger, one electrode being directed to the neck, and the other over the lower ribs at the left side. The same treatment was used in the two fatal cases, but in the first of them other means were tried first, and some time had elapsed before the current was employed; in the second case, however, it was used at once and failed. In the latter case such extensive fatty degeneration of the heart was discovered, that 'when its action had once ceased, no artificial stimulus could have restored it.' Galvanism (Mr. Green says) will excite muscle to contract, but cannot impart motion to 'rows of fat.' In the five latter cases which recovered, the stoppage of all motion in the heart and lungs was so complete, and the restoration so instantaneous, that no doubt could remain as to the value of the agent employed.

"The same surgeon justly lays stress upon the importance of having a faradic apparatus at hand, ready to act immediately when required, as in many cases where death ensued, much time was lost by first using other means, then sending for the apparatus, adjusting and employing it. Seconds or minutes may make all the difference between life and death. Mr. Green, therefore, has for many years not ventured to operate under chloroform, either at the infirmary or in private practice, without having the faradic apparatus ready for instant use; and expresses the opinion that chloroform should never be administered without the same precaution being taken. He believes that in his cases he had caused the faradic current to act directly upon the heart; but it is evident from his description that he acted upon the diaphragm, and thereby caused artificial respiration.

"Mr. Prichard, of Bristol, has described the case of 'a courageous and energetic old lady,' who was to undergo removal of the breast for cancer, who took leave of her husband—'a poor feeble-minded old clergyman'—in the dining-room, and walked up to her bedroom for the operation. During the operation, which was more than usually difficult, in consequence of adhesions to the fascia and muscle, she suddenly ceased to breathe, and instantly became quite pulseless. Recourse was had at once to the battery, and in a short time she gasped, and afterwards breathed again. Her state appeared to be one of excessive and almost fatal faintness, and the effects of faradisation were marked. The operation was completed, and she did well.

"Another case under the care of the same surgeon was that of a man, aged 74, suffering from a large strangulated scrotal hernia. After trying taxis, chloroform was given, and more attempts

made to reduce the mass, when attention was suddenly called to the state of the patient, whose pulse had ceased while the house-surgeon had his finger on the wrist, and all respiratory movements stopped at the same time. The old man appeared to be dead for half a minute; but the battery being at hand, the electrodes were applied to his epigastrum and the back of his neck, and he immediately started into life and struggled to sit up. The hernia was reduced.

"Two years and a half after this occurrence, he was again admitted with symptoms of acute strangulation. After trying the usual means, it was determined to operate; and the old man fell again into a death-like syncope at the first inhalation of chloroform. He was aroused by faradism in the same way, but died three days afterwards of sphacelus of the scrotum and integuments around.

"In *Opium-poisoning* the same treatment has done good service. Dr. Lucas, of Brecknock, has used it in the case of a girl aged 11, who had swallowed an ounce and a half of laudanum, sent to her in mistake for a black draught. She soon became very drowsy, and in spite of the use of the stomach-pump, walking about, and sinapisms to the feet and legs, became comatose, so that seven hours after taking the poison she could no longer be roused by shaking or loud speaking; the lower jaw dropped, breathing was stertorous, respiration 6, pulse 100. Faradisation of the upper cervical region, and over the epigastrum, chest, and face, however, now aroused her, so that she was able to swallow a grain of Ext. Bellad. dissolved in a teaspoonful of water. This was repeated at intervals, so that she had five applications of faradism, and 16 grains of Ext. Bellad. in four hours, when she appeared out of danger. She made a good recovery. Probably much good was done in this case by the belladonna; but without faradisation the patient could not have been roused to swallow anything. (It is true that the belladonna might have been introduced by the rectum or by the skin.)

"Ziemssen recommends to faradise in these cases not only the phrenic nerves, but also the motor nerves of those muscles which act in combination with the diaphragm; that is, the branches which proceed from the cervical plexus to the trapezius, levator scapulae, and scalenus medius muscles; the nervus thoracicus anterior, which animates the pectoralis major and minor; and the nervus thoracicus posterior and lateralis, which proceed from the brachial plexus to the scalenus medius, serratus anticus, and the rhomboidei. The electrodes should be placed there for about two seconds at the time, in order to produce a deep inspiration; after which expiration is affected by an assistant pressing the abdominal parites from below upwards. It has been pro-

posed to promote expiration by faradisation of the abdominal muscles, but Ziemssen is not in favor of this proceeding, because he thinks it impossible to produce such a powerful compression of the contents of the abdomen by faradisation as may be effected by mechanical pressure on the parietes, and by pushing the diaphragm upwards. The current should be powerful and rapidly interrupted. If after the first few times no effect is produced, the intensity of the current must be further increased, as otherwise the excitability of the respiratory nerves might completely vanish.

"Onimus and Legros think the continuous current preferable to faradisation. They have experimented on rats, mice, rabbits, and dogs, with ether, chloroform, and nitrous oxide gas; and have found that after respiration had ceased, and the animals had been apparently dead for two or three minutes, a continuous current applied to the digestive tract restored them to life. They recommend to place the cathode into the mouth, and the anode into the rectum, and to apply the current continuatively, until respiration and the heart's action are quite re-established. A current of twenty cells would, according to them, be sufficient for man. Faradisation will, however, in most cases be preferable, because it is easier to use, and when used at once, almost invariably seems to answer."

This we regard as sufficient to excite an interest in this department of electro-therapeutics, and any ordinarily intelligent physician can apply these methods without further instructions.

GALVANO-CAUTERY AND GALVANO-CAUSTIC BATTERIES.

On pages 16 and 17, Piffard's Galvano-Cautery is described and illustrated, and its management, a full explanation of its application and uses, promised.

In the use of any galvanic cautery, it should be understood that no current of electricity is applied to the part operated upon, or to any other part of the body. The current is simply utilized to heat the instrument used in the cautery operation—wire, knife or other instrument. And the heat thus produced is not unlike heat from ordinary sources. The advantages of this method of heating cautery instruments are, the more perfect control of the operator over the degree of heat required, and the continuation of the proper temperature for an indefinite time. And galvano-

cautery instruments may be so constructed as to be readily applied to limited parts of the body not easily reached by ordinary cauteries.

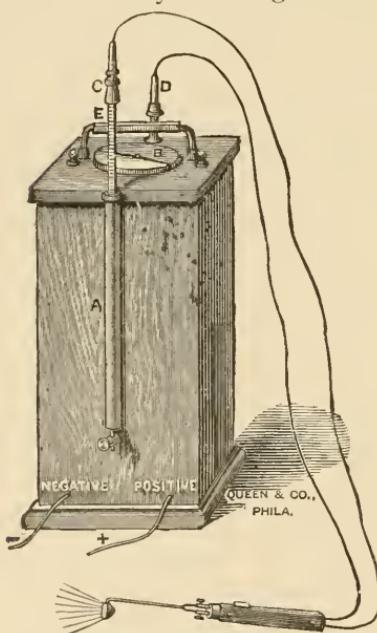
The conducting cords leading from the positive and negative poles of the galvano-cautery battery, which are made of a number of small copper wires, pass through a holder or insulated handle, and are then connected by an intervening loop of platinum wire, or a loop-shaped instrument made of platinum, fastened to the wires with pure gold solder. Thus it is seen that when this battery is in operation a complete circuit is formed. The current passes from the battery through the conducting wire leading from the positive pole, to the point where it is attached to the loop of platinum wire or loop-shaped platinum instrument, then through this and the copper wire attached to the negative pole back to the battery.

The great resistance offered by the intervening platinum wire, or instrument, results in the evolution of intense heat. Platinum wires or instruments may be heated by this method to a red or white heat; or they may be melted, even fused, but such a degree of heat must be carefully avoided, for this would result in destruction of the instrument and a postponement of operations. Incandescence, or a degree approaching a white heat, is sufficient.

Regarding the use of the galvano-cautery, we may appropriate it wherever we desire to cauterize or destroy a part; and for the purpose of removing tumors and excising malignant growths. For the convenience of operators, and to meet the requirements of different cases, a variety of burners, handles, knives, wire loops, etc., all made of platinum, have been invented, some of which are shown on page 17. All that is necessary in galvano-cautery operations is to get the battery in good order, full directions for which accompany each style or form of instrument, then select the burner, knife or wire loop that appears to be best adapted to the case in hand, attach it to the battery, anaesthetize the patient, fix the burner properly upon the part to be destroyed or excised, put the battery in operation and close the current. When the operating instrument reaches a degree of heat approaching incandescence, then it may be manipulated as the

case may require; if a wire loop, it should be gradually contracted till it cuts and burns its way through the part. The traction on the loop should be slow, so that, as it cuts its way through, the whole surface of the wound may be thoroughly cauterized. This lessens the risk of hemorrhage, and the operation is more satisfactory than if performed hastily, and bleeding is troublesome. When other forms of burners or knives are used, the same care should be observed, and no galvano-cautery operation should be hastily performed. After an operation with any of these burners, the wound is prone to heal kindly, and only requires to be well protected, or dressed like wounds after ordinary surgical operations.

While Piffard's battery, already referred to and nicely illustrated, is regarded as an excellent instrument for galvano-cautery operations, it, like Byrne's battery, has its inconveniences, and we are always looking for something better, if we can find it.



TROUVE'S POLYSCOPE.

Fig. 30.

is connected with two of Bunsen's cells, or four of Daniell's,

It is a fact, that these batteries require great care, and no little skill to handle them successfully. The exciting fluid is too feeble, the zincs are not clean, the connections are dirty, or something is apt to be out of order, and they must be well tested before we commence any operation.

There is an instrument lately introduced that is likely to supersede all other galvano-cautery batteries. It is called Trouve's Polyscope. See illustration, Fig. 30.

In constructing the polyscope, Plante's cell is used and is called in this instrument the secondary cell.

To charge the polyscope, it

which accompany the instrument. Before connecting it, the secondary cell, the cell of the instrument proper, is filled with water containing ten per cent. of sulphuric acid. The instrument thus prepared, and connected with the two Bunsen or four Daniell cells, is left in action for six, ten or twelve hours. In proportion to the time, the secondary cell will be found to be charged with more or less electricity. The polarized current is said to be stored up in the secondary cell, and may be used at pleasure. In order to draw it off and appropriate it, it is only necessary to attach ordinary galvano-cautery conducting wires to C. D., when the current will flow continuously until the supply stored up is exhausted. At the bottom of the illustration, marked — and X, are represented the wires for attaching the Bunsen or Daniel cells used for charging the polyscope. At the top are poles for attaching the conducting wires, to which the burners, such as are used with other galvano-cautery batteries, are fastened. A. is a rheostat, for regulating the resistance or strength of the current. B. is a galvanometer.*

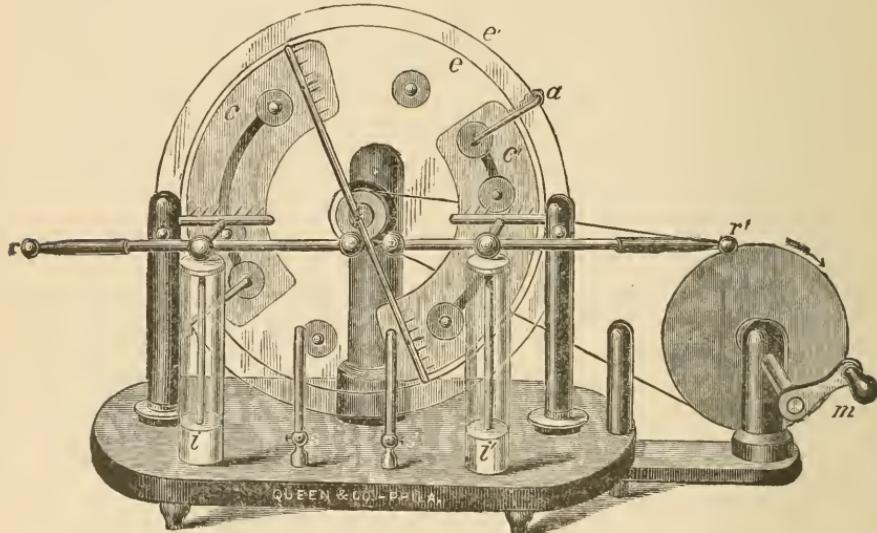
This is certainly the most satisfactory arrangement for a galvano-cautery instrument yet suggested, for it is always in order, and under the complete control of the operator. And it is also conveniently used for heating the wires of illuminating instruments, a sample of which is seen attached to the polyscope in the illustration. Dr. Wellington Adams' electric laryngoscope is nicely operated with this instrument.

STATIC OR FRANKLINIC ELECTRICITY.

On page 6 static or Franklinic electricity is referred to, and friction, cleavage and pressure mentioned as means of generating it. For appropriation in therapeutics, static electricity in ample quantity and of the required intensity is more readily generated by friction. As it is generated it is condensed or stored up in Leyden jars for the time, and drawn off or discharged, as the operator may determine, and as may be required.

*For this description and illustration, we are under obligation to James W. Queen & Co., of Phila., who furnish this beautiful instrument complete to those who want it.

Fig. 31 represents the Toepler-Holtz machine, as furnished by James W. Queen & Co., of Philadelphia. It is one of the best instruments for the generation of static electricity now in use, and for the application of this form of electricity in therapeutics it gives entire satisfaction. I have this machine in my office, and it is always ready, works well in all kinds of weather, dry or damp, never failing. And no glass case to protect it from dampness, no basin of sulphuric acid, nor any drying substance, like chloride of lime, are required. The machine is perfect within itself, and is under the perfect control of the operator.



Nos. 2, 3 and 4.

Fig. 31.

As here illustrated, this machine consists of two glass disks, e, e'; some paper coatings, c, c'; a number of conductors made in a comb shape, as seen in the illustration; two Leyden jars, i, i, and two discharging rods, r, r'. The glass disks and paper coatings are well covered with sealing-wax. When the machine is in operation one of the glass disks revolves on its axis, while the other remains stationary. The whole is mounted upon a fine mahogany platform, to which is attached a wheel and

crank, upon which we place a round belt. The machine is put in motion by simply turning the crank with the hand. An electric motor or water motor may be used to operate the machine, where turning the crank is objectionable.

Some physicians incline to the belief that larger machines than this are required, and that Toepler-Holtz machines with several plates instead of two should be used, so as to get additional quantity. While we know that excellent results follow the use of this machine, and that much smaller ones give good satisfaction in many instances, it is possible that larger machines might be more efficient in certain cases.

Accessory to the machine are, an insulating chair or platform, a rod or chain for connecting the machine with this chair or platform, a few electrodes for drawing and giving sparks, and two brass chains with clasps on the ends, all to be used as hereafter described.

Regarding the use of static electricity, we should have some well-grounded principles to operate from. We have experimented with the faradic and galvanic currents to our satisfaction, and have found them, each in its time and place, all that could be reasonably expected. Although static electricity is really the same force, it appears under a different phase, and great differences in indication for use exist, not only in the nature of the electricity used, but in the manner of using it. This we have learned from our experiments with faradic and galvanic currents.

Dr. W. J. Morton, of New York, says this:

“ Leaving behind us all statements as to accepted actions of different forms of electricity, and their comparative characteristics, there remain two views of electrical curative action which lean with great force to the side of statical electricity, and at the same time account, in a satisfactory manner, for results which have been doubted because they did not fit into a prevalent theory. We may now ask the special question, *Why, above and beyond other forms of electricity, does statical electricity cure?* I will offer two explanations, and these are, *a*, first, simple mechanical disturbance, followed by a local alteration of nutrition; and, *b*, secondly, reflex action from irritation of the peripheral distribution of nerves.

“ With regard to the first, when the electric discharge, in the

form of a spark, takes place in a resisting medium like the various parts of the human body which are submitted to it, a very great mechanical disturbance in the tissue at the point of discharge must inevitably result. A piece of paper, for instance, held between the electrode and the skin is perforated by the spark. A parallel to the mechanical action referred to, though in a less localized and less powerful degree, is to be found in ordinary physical exercise or in massage. From this point of view, static electricity by the method of sparks has, in a special degree, owing to its high tension, great advantages. The spark strikes a sharp, incisive and penetrating, though scarcely painful blow, and often repeated in a given region creates, by simple disturbance, a great alteration in the nutrition of the part. This, at least, is the only way in which I can account for the almost instantaneous relief and cure, after a few applications, of a large class of pains seated in deep and superficial fasciæ, and due to sub-acute and chronic rheumatism. Neither blisters, other violent counter-irritation, nor medicine, will dissipate these pains, while, on the other hand, static electricity will subdue them at once.

"The contraction of muscles is also often due to this same mechanical effect of the spark, just as muscles of the thigh may be made to contract by a snap of the finger or sharp blow from a percussion hammer.

"With regard to the second explanation—that by reflex action following a peripheral irritation of the terminal sensory filaments and endings—a very intricate question is opened, which we can no more than glance at here.

"How can simple electrification by insulation and the drawing of sparks, it is asked, produce the decided effects that are claimed for it? Static electricity, it is said, owing to its high tension, accumulates merely on the surface of the body, and does not penetrate into the deeper organs, while the spark is merely the briefest kind of current.

"Recent investigations on the irritative action of applications to the skin have thrown a new light upon this question, and show that, though previously unexplained, the effects of the great accumulation of electricity on the surface and the sharp blow of the spark were, in truth, effects based upon a true physiological principle, the principle named by Brown-Séquard, its recent expounder—"the phenonema of inhibition." A few drops of chloroform applied to the neck of a guinea-pig produced, on some occasions, an epileptic attack; on others the nerves and muscles became highly excitable to stimulation.

"But the most notable effect of irritating applications of chloroform, as well as other substances, was a general anæsthesia;

reflex symptoms were inhibited and muscular excitability lost.

“As we have as yet received but extracts of Brown-Séguard’s communications, we must wait for fuller development of his ideas. But an interesting element has entered into our physiological and therapeutical studies—that of the reflex phenomena of peripheral irritation. And we may at once place under this single heading a large number of facts long familiar.

“External irritant applications, in one form or another, have always formed an important element in medical treatment. And most of these applications have been used to relieve pain, or in some way modify the general sensibility either in contiguous or remote parts.

“Familiar examples are blisters, sinapisms, cupping, the actual cautery, ammonia, the moxa aqua and acupuncture, and in later days the magnet, the tuning-fork, and hypodermic injections of water into the thoracic walls for the purpose of allaying the cough of phthisis. The latest novelty in this direction is the electric percutor of Baudet, consisting of a tuning-fork kept in vibration by electricity, and communicating to any desired nerve or part by means of a slender rod; the mechanical vibrations originated in the fork.

“Charcot, after cautious experimentation, has given his adherence to the statement that metals (metallo-therapy) do produce effects contiguous and remote when applied to the skin—that the magnet also produces similar effects, both upon general sensibility and muscular power. Vigouroux has pointed out that the vibrations of a tuning-fork, either alone or communicated to a sounding-board, provoke similar phenomena.

“Here, then, in this collection of well-known facts, and in the broad generalization of Brown-Séguard, drawn from his recent experiments, we have, at last, it seems to me, found the law which governs the results produced and to be expected from statical electrification, as well as from some other uses of electricity. This law is the effect produced upon remote parts by affecting the peripheral distribution of the sensory nerves, and the effect produced is most commonly relief of pain or spasm in a remote part. And in this principle of inhibition from peripheral application may doubtless be found the explanation of many of the definite and hitherto inexplicable effects of static electricity.

“The ‘insulation’ alone holds the entire sensory peripheral distribution of the skin in its grasp. Every nerve-filament is vibrating, is polarized, or affected, whatever term we choose to use, by the tense layer of electricity or electrical influence collected on the surface, there bound by the natural laws of physics, and only waiting to be drawn off by a spark or diffuse

itself gradually into the atmosphere, while in the spark itself is found a still more potent and localized stimulating agent."

Dr. Romaine J. Curtiss, of Joliet, Ill., in a paper written for the AMERICAN MEDICAL JOURNAL, communicates the following:

"The action of electricity in curing disease—for instance, in relieving neuralgia—is, of course, obscure; but it is the question everybody naturally asks, and everybody would like to know. It is not necessary to say that the remedy acts by any particular chemical effect, or that it really exerts any effect much more than mechanical. Its primary effect is a series of shocks, to skin, muscles, nerves, and all tissues through which the current is passed; and part of the electricity is converted into heat by the resistance of the tissues, as we would suppose by reasoning from the *a priori* stand-point, and as we really find by actual trial of the remedy. The patient will always speak of an increased temperature if the current is passed through a considerable part of the body for ten or fifteen minutes.

"The reasons for supposing that the primary effect of the static current is simply mechanical are as follows: An instrument has been invented by somebody (I do not recall the name), called, I think, a *percutor*. This instrument is made with a vibrator which strikes rapid blows, with greater or less rapidity and intensity. When these blows from the instrument are directed upon the skin, the effects are identical with those of electricity. The relief of pain, the tonic effect, the remote therapeutic effects, and the temperature effects, are the same, or nearly so, in each case. The *percutor*, according to the inventor's reports, is performing some remarkable cures. He even undertakes to cure brain disease, and organic spinal-cord disease, by the action of the *percutor*. In such cases, the instrument is applied generally over the peripheral ends of the distributions of nerves which have their origin in or near the diseased part.

"Now this principle is an old one of electro-therapeutics. Nearly all authors speak of benefit in paralysis from brain lesion by electrization of the paralyzed muscles. If other things are equal, benefit in such cases can only result by reason of repair of the brain lesion, consequent upon electrical action upon the muscle nerves, and the transmission of this therapeutic effect to the brain tissues.

"At all events, my belief is that the therapeutic effect is, in either case, the result of mechanical shock. No tissue can receive a mechanical shock without increase of its molecular activity, if the shock is therapeutic at all, and, without doubt, diminished nutrition or blood supply, and nerve action, and per-

haps *pain* (the subjective side of either or all of these conditions or the opposite conditions), is a diminished molecular activity. The mechanical force of the *percutor* or static machine is transmitted to the tissue; it *must* excite corresponding motion or heat, and it probably does both, with the effect for good or evil which we get from the use of these remedies."

These observations, recorded by Drs. Morton and Curtiss, doubtless express the principal facts, so far as known, regarding the therapeutic action of static electricity. But we are inclined to the opinion that the peculiar (mechanical) disturbance resulting from the application of this form of electricity accomplishes *a great deal more*, in a therapeutical point of view, than can possibly be hoped for from the use of percutors, or any form of massage, or massage instruments. While we cannot understand exactly *how* a therapeutic measure accomplishes a certain end, we need not limit its influence to a comparatively narrow compass, till we have waited and watched. Time will develop the fact that while static electricity is capable of accomplishing much through pure mechanical influence alone, results unexpected and even astonishing follow its use, that are not accounted for in the observations of Morton and Curtiss. We may understand these things better after a while.

With these observations and experiences before us, we are ready to consider the various forms of administering static electricity, and point out, if we can, the particular conditions indicating their use. There are four of these forms, viz: Insulation, sparks and sprays, shock, and the static induced current. Of these, insulation, sparks and the static induced current are eminently practical; the shock is disagreeable to the patient and is not much used.

It is well known to experienced electricians that in the use of the faradic and galvanic currents a complete circuit must be formed by interposing some part of the body between the positive and negative poles of the battery, before any impression is produced upon the subject. Simply connecting a patient with one of the poles, let it be positive or negative, will not result in faradization or galvanization of the part so connected. Not so with static electricity. One pole is sufficient to fill the patient full of electricity, so to speak.

Insulation.—This is generally termed the electric bath, and it affords a good illustration of the above statement, that static electricity is directly conducted to the patient by one pole. First, we prepare an insulating chair, stool or platform, by simply slipping glass cups, or rubber caps made for the purpose, under the legs of the chair or stool used. Then this insulating chair is connected, by means of a brass chain or rod, to the prime conductor of the machine. The patient is seated upon this chair or stool, and is said to be insulated—separated from direct communication, electrically speaking, with the earth. We now commence to operate the machine. As electricity is generated, and condensed in the Leyden jars, it is silently conducted to the patient, without any painful sensations, and is gradually and silently discharged from the body to the surrounding atmosphere, producing very pleasing effects. The hair of the head stands up, a pleasant sensation of warmth comes over the body, the patient perspires, and if the sitting is continued for twenty to thirty minutes a feeling of drowsiness comes on. If continued too long, a tired feeling is complained of. All this time it will be observed that the pulse is more rapid than usual, and the face is apt to be flushed. Upon the whole, these sittings are exceedingly refreshing to invalids, and they prize them highly. If very strong electrification is desired, the connecting rod, or chain itself may be held in the hand of the patient while it is connected with the prime conductor, the patient still on the insulating stool.

This is the electric bath, or static electricity administered by insulation or silent conduction.

Sparks.—Going back to the machine, we direct our attention to the discharging rods, r r. These rods are not stationary, but are readily drawn away from each other, or they may be moved till their ends are nearly or quite in apposition. If we move them a little, so they are barely separated, and then put the machine in motion, we observe that electricity is discharged with a crackling sound, and accompanied by vivid sparks, made up of exceedingly minute particles of the electrode used, and the air in an incandescent state. The length of the spark, as well as its shape, is regulated by the distance between the ends

of the discharging rods. When the rods are close together the sparks are straight, are emitted in rapid succession with a fine crackling sound; but when the rods are separated two, four or eight inches, the sparks become curved or zig-zag, like lightning, are not discharged so rapidly, but with a louder report.

Now, electricity in the form of sparks may be passed through parts of the body in the following manner: We first insulate the subject, as in giving the electric bath, and when the patient is well charged, sparks may be drawn from any portion of the body by the near approach of a suitable electrode, more or less directly connected with the earth. When the electrode is simply held in the hand of the operator we have an earth connection, but it is not quite so direct, and not nearly so perfect as when it is attached to a brass chain, which is connected with a gas pipe or some other metallic substance leading directly to the earth. Brass balls of different sizes mounted on glass handles, directly connected with the earth, are generally used in drawing sparks. Regarding the practice of drawing sparks Dr. Morton makes the following observations:

"The patient is first insulated; in this condition sparks will fly between any point of the body and a conductor more or less directly connected with the earth. Their strength and shape may be graduated within large limits by the operator, from a minute prickle to a blow passing through six inches or more of intervening air. (That is, where the electrode is held close to the part the sparks are more rapidly produced and are less exciting than long sparks.) In certain forms of anaesthesia and paralysis, as well also as along the spine, which is particularly insensible to their superficial effects, these long sparks may be used with great advantage. A little practice shows in what regions strong sparks are not disagreeable and in what regions they are painful. The question as to whether the spark is considered painful or not further depends upon the size and shape of the electrode. The spark from a brass ball two inches in diameter causes no pain, while a spark of the same length from a quarter-inch ball causes a prickling sensation. I much prefer, on many accounts, the large electrodes. In all instances, in 'drawing' sparks I use a ground connection, easily effected by connecting the chain to the nearest gas- or water- pipe. The operator may employ a great variety of electrodes, large and small metal balls, or balls of wood, charcoal, and other substances. A large metal ball

and a sharp-pointed rod are in general sufficient, though special forms are needed for the ear, mouth, nose, and some other organs.

"It is never necessary to remove the patient's clothing, since the sparks pass through any fabric without injury to it, and without any diminution of their effect. When a spark of considerable strength strikes the skin, a whitish spot is seen at the point of contact and in regions where there are hairs, a condition resembling "goose-flesh." A little urticarial wheal, even, may appear on sensitive skin, which is soon replaced by slight erythematous blushes. These effects disappear in from half an hour to two hours.

"We administer sparks to excite muscular contractility, to excite the function of organs and special senses, to cure by reflex action, and to stimulate the general skin surface. For this latter effect a metallic roller electrode is desirable.

"But the spark may be pre-eminently antispasmodic. Its action in this instance depends upon the cause of the spasm. If of central irritative origin, the sparks are drawn from the head and back of the neck; if local, from the affected part; if from a reflex, from the peripheral point which controls the reflex. Oftentimes when the distribution of a motor nerve can be reached, a spasm may be at once controlled by the simple mechanical numbing effect of a succession of sparks. For instance, in a patient subject to violent tonic spasm of a great number of muscles on the left side, particularly the region supplied by the facial nerve and the spinal accessory, I have often made this experiment.

"At times, when an attack was coming on, about to last invariably several hours, I have applied the static induced current (equivalent to the current from the ordinary faradic battery) to the facial nerve, and caused the facial group of muscles to respond, not in a clonic but in a tonic manner, *i. e.*, the mouth strongly drawn up at the corner, the eye closed, etc., etc. In less than a minute a few sparks would resolve this spasm. Again produced, it could be again as quickly resolved, and this repeated as often and in as varied a manner as desired. In torticollis, in spasms of irregular forms of epilepsy, and in a large variety of hysterical spasms I have seen the same results, as well, also, as in muscles grown rigid by pain, rheumatism, or paralysis of their antagonists.

"In the relief of neuralgic pain the spark is in most every instance successful, often instantaneously (ten to twenty minutes).

"In subacute and chronic rheumatic pains, its curative power is equally certain and rapid. I have never seen from medication results at all comparable to the effects of static electricity. A

variety of rheumatic pains, characterized by deep-seated, constant, wearisome, and disabling pain, oftentimes translatable, generally worse upon getting up in the morning, is relieved with great certainty and at once. The same is true of muscular rheumatism."

The Static Induced Current.—This is produced in the following manner:

"The operator is provided with two brass chains, such as are used with an electrical machine, and they should have a clasp at one extremity. One chain should be clasped over the left hand discharging rod, marked *r*; the other should be clasped around the base of the right-hand condenser, marked *i*. To the other or free extremities of the two chains should be fastened the usual sponge electrodes, moistened with water. The discharging rods should now be approximated, but should not touch. When the plate is made to revolve, sparks pass between the ends of the discharging rods, and if the electrodes are applied to the thumb muscles—for example—the following phenomena ensue: If the discharging rods are placed nearly together a very fine tingling is experienced; if further removed, the tingling is more decided; and if still more separated, so that distinct sparks pass, active muscular contractions take place. The impression made by the electricity is like that of the faradic machine, but is much less painful; and strong muscular contractions are induced with greatly less pain than can correspondingly strong contractions of the muscles be obtained by faradism. I have found that the fine current, which is nearly continuous, affords relief in neuralgia, muscular rheumatism, chorea, etc., and the strong intermittent current to act most energetically on muscle."

This is Prof. Bartholow's method of using the static machine for the production of the static induced current. This use of the static machine is available in many cases; and while this static induced current may not entirely take the place of faradism, it is doubtless capable of giving better results in some cases than can possibly be obtained from faradization. In the use of the static induced current the patient need not be insulated, as in the cases of silent conduction or electric bath, and where sparks are drawn, but may occupy an ordinary chair.

Regarding the specific therapeutics of static electricity, we are greatly pleased, and have quite a number of authentic cases, from different sources, on record, illustrating its merits and inestimable value.

The following practical observations are abstracted from an original paper written for the AMERICAN MEDICAL JOURNAL, by Romaine J. Curtiss, M. D., of Joliet, Ill. :

"In the use of the static machine I do not use an insulated table or platform, but seat the patient in a chair with his feet upon a metal plate, to which one of the poles is attached, while the other pole is applied on or close to any part which it may be required to act upon.

"The machine I use was made by P. Atkinson, Esq., 168 Randolph St., Chicago. The machine is made with apparatus attached to the outer metal of the Leyden jar, which discharges the electricity from the jar simultaneously with the discharge between the poles of the jars. Drawing the poles apart, then, regulates the forces of the spark. The current used in this manner is called the *static induced* current.

"In general terms I can say that static electricity will relieve pain in neuralgic diseases even better than galvanism. As a general tonic I am very greatly pleased with its effect, especially if the tonic is required on account of weakness of the nervous system.

"In rheumatic diseases electricity is most always useful, and I have yet to find a case of rheumatic disease which I have failed to benefit or cure with static electricity.

"Most of the diseases which are notably benefited by static, as well as other electricity, are nervous and rheumatic affections. I have used the remedy particularly in neuralgia, and in that many sided disease, spinal irritation, and most always with good effect.

"A characteristic effect of static electricity in rheumatism and neuralgia is an immediate relief of pain. In chronic cases the pain will be relieved almost entirely, and remain so for 12 or perhaps 24 hours. The pain will then return with less severity, and another dose will again relieve. It is obvious that continuation of such treatment, when electricity has this effect, will result in cure; and I have found this method to be that which the remedy takes in effecting a cure when it is successful.

"With regard to the length of the spark when used for therapeutic purposes, I must emphatically say that I do not believe in lengthening the spark a particle beyond what is compatible with the *ease* of the patient. I think everybody's experience will prove that if the electricity hurts when it is used, it will do hurt. I began the use of static electricity by giving sparks from an inch to two inches long. I have stopped it. I begin the application of the current by making the sparks so short that the patient can just feel it. I then lengthen them until the current

can be distinctly felt, and I think the current can then do all that static electricity is able to do in the cure of disease.

" The preparation of the patient for an application of static electricity is, so far as removal of clothing is concerned, of great advantage over other forms of electrical application. The static current goes through the shoes, even through some rubber shoes, and no clothing is any impediment to the sparks. The only disadvantage of the clothing is that the electrode is necessarily measured in its distance from the surface by the thickness of the clothes, and therefore the thicker the layer of clothing the longer the sparks and the more pain. If the current is painful some of the clothing must be removed.

" In the practical use of electricity the force is used, or ought to be used, as any other remedy is, and by this I mean it should be used as auxiliary to other remedies, or other remedies should be used as auxiliary to electricity. It is certainly the minimum of cases which come under the physician's care which require only one remedy, or in which the physician can afford to limit himself and patient to one remedy for the sake of learning the therapeutical effect of that remedy. I generally use electricity as an auxiliary to other treatment. Therapeutically I think this is the proper method. Medicines and remedies are classified physiologically according to their physiological effect. As a rule, whenever there is a therapeutical ' indication ' for a remedy, several medicines having the same, or nearly the same, physiological effect are prescribed.

" Suppose the indications are to lessen the size of the capillaries in the brain. The physician will combine together several remedies which have the same general effect, and perhaps his combination for this purpose will be potass. bromide, fld. ergot and hydro-bromic acid. The sociological principle put forth by one of the revolutionary patriots—' United we stand, divided we fall '—is a good therapeutical axiom as well. A combination of remedies, having the same general effect, may succeed where one of them would fail. I append a few cases illustrative of the clinical uses of static electricity:

" CASE I.—Mrs._____, aged 62 years, keeps a jewelry store. During the past six months patient says she has had ' sciatic rheumatism,' and has been under the care of a domestic supply of homeopathic medicines, and occasional supplementary advice of an auxiliary physician to the same. On examination I find the patient's diagnosis very nearly correct; in fact the disease could very well be called ' sciatic rheumatism.' The region of the sciatic nerve was painful, the muscles swollen, the knee joint could not be flexed, neither could the ankle, without pain. The patient could stand and walk, but walked without flexing

the knee and ankle. The pain was referred to the joints, and throughout the distribution of the sciatic nerve, and was most severe at night. Patient could not flex the joints, or draw up the limb at night, and when she was helped up, generally stood on her feet behind the counter all day.

" The medicine given in this case was salicylate of quinine, and the static induction current was applied every day for eight days. The relief to the pain and stiffness was marked at each application, and the usual morning greeting of the patient was, 'I am a hundred per cent. better.'

" The patient called herself well after the eighth day.

" **CASE II.**—Capt. H., aged about 40, weight about 235 lbs., a foreman in a manufacturing establishment, was attacked by sciatica. He was confined to bed and room ten days, and attended by a physician. During this time he improved somewhat and was then worse again. Being called to see him I advised static electricity, and the patient came to my office with great difficulty. The slightest movement gave him great pain. He walked from his carriage into the office by the aid of two crutches, with loud groans and abundant perspiration. Being seated on the chair with his foot on the metal plate, I applied the other pole over the origin of the sciatic nerve next the skin. The current was used with the shortest possible sparks, or rapid shocks, for perhaps fifteen minutes. At this time the pain was entirely gone; the patient made his usual effort to stand up by aid of his crutches, but went up so much easier than usual that he came near falling over forwards. After trying his motions and adjusting his clothing, and making one or two steps by way of experiment, he 'shouldered his crutch'—one under each arm, and marching out, 'showed how fields were won' in therapeutics by static electricity. Of course the pain returned after a few hours, but with less intensity, and the patient returned every day for twelve days, when he called himself well. I gave no medicine in this case.

" **CASE III.**—Mr._____, aged 50, Englishman, and skilled laborer in the rolling mills. This patient was laid up with chronic rheumatism. He had been off duty for over three months when he came to me for advice. The rheumatism was confined principally to the muscles of the arms and shoulders, was transitory and migratory.

" At one time perhaps his left arm would be useless by reason of affection of deltoid or some other muscle or set of muscles, and in a few days there would be a change to the other arm or shoulder, then a hand would show the disease, and the fingers would be swollen and painful for a few days.

" I treated this patient for six weeks with medicine and elec-

tricity. The medicines used were salicylate of quinia, iod. potass., colchicin aconite, black cohosh, and finally large quantities of quinine and iodoform.

"The static induced current was used three or four times a week. Its use was continued for the reason that it never failed to give immediate relief. If a shoulder, or arm, or hand was disabled, fifteen minutes' use of the current would restore motion without the usual accompaniment of pain. At the end of six weeks the patient resumed his skilled labor.

"CASE IV.—This patient was a young farmer, who was disabled by a complexity of obscure symptoms. He had been idle a whole summer by reason of unpleasant sensations referred to the loins, hips, sciatic region, and pains and aches sometimes affected his spine, and the nerves between the ribs. He had suffered many things from many physicians, without relief. A traveling specialist had treated him for tape-worm. A surgeon sounded him for stone in the bladder. A female clairvoyant 'seanced' and 'passed' him. A homœopath had fed the nectar loving pathological god of his hobby with powerful potencies, concealed in the sweet disguise of sugar of milk. A 'water doctor' had viewed his urine and collected his pay. A physician had detected over sexual indulgence, and prescribed total abstinence for the old man Adam, which the patient declared hurt him more than anything else, for he 'felt better,' he said, by leaving the sexual instincts to Nature, and gratifying his longings 'once a week.'

"I examined this patient carefully with relation to the existence of organic lesion and could find nothing. There was no indication of disease afforded by microscopical examination of the urine. The heart and liver, brain, kidneys, and bowels seemed to be free from disease. I could not satisfy myself that he had rheumatism or malaria, and I classed his disorder under the head of those spinal lesions which are not organic, but which, by errors of nutrition or circulation, will cause these symptomatic affections of motor and sensory nerves.

"I concluded to try the static current, and placed the patient in position, his feet on the plate, and I applied the other pole over the spine. The patient had his coat on, which made it necessary not to use very rapid shocks, and rather long sparks. I first applied the pole over the spine and under the scapulæ, and gradually worked downwards over the sciatic region. At first the patient did not complain, but as I approached the sciatic region he began to wince, and while I was telling him I thought he could stand it well enough, 'it wouldn't hurt him much,' he fell off the chair in syncope, or a fainting fit.

"I applied the usual restoratives from a pitcher, but the pa-

tient declined to try any more of the remedy, and didn't for several days. He returned, however, and was under treatment for three months by use of the static induction current, and was cured of his spinal irritation. The current was applied with use of very short sparks, mostly applied by the positive pole to the lumbar region, and the current went through the lower extremities. The tonic effect from these therapeutically applied shocks to the sacral and lumbar nerves restored the integrity of the spinal cord. I suppose 'nerve stretching' would have served the same purpose, this procedure acting, in all probability, in no other manner than by causing a nervous shock.

"CASE V.—The use of static electricity in this case fully illustrates the benefit of this agent when used for its general tonic effect. Mrs. ——, a widow, age about 30 (by guess), was left by misfortune with two children and no property. She worked and worried for three years, and then broke down. She was the type of neurasthenia in its most general variety, and if she had nerve exhaustion she also had muscle exhaustion, and digestive exhaustion, and in fact general exhaustion. The sensory nerves were painful, the motor nerves were paretic, the digestion was impaired. She had no appetite, was sleepless, melancholic, and the general picture of physical and mental exhaustion.

"Of course rest was prescribed, and, as auxiliaries, the static current and the following medicines: Erythroxylon coca, elix. strychnia and quinia, tr. digitalis.

"The patient required three months for recovery, and was treated by the static current every day. The usual method of application was to begin the dose by passing the current from feet to hands for a few minutes, and then applying one pole over the back, paying particular attention to the location of origin of spinal nerves.

"The electricity was believed to be a valuable help for the reason that the immediate effects were always of such benefit as a tonic and stimulant.

"CASE VI.—Mrs. ——, taught school six years and then married, and was probably 30 years of age, when she began to lose appetite and flesh, have numbness of the extremities—both feet and hands, and catarrh of the pharynx.

"This condition of things prevailed for a few months, when she began to cough ominously, and advice was looked for. The diagnosis was spinal irritation, and in this case the treatment was by static induced electricity alone. There were painful vertebræ at different spinal localities, and the current was specially directed to these points. In about three months the numbness of extremities and tenderness of vertebræ disappeared, ap-

petite improved. cough ceased, and the catarrh of the pharynx being a symptom of the pathological condition recovered itself.

“I mention these cases as fair types of the diseases in which static electricity is useful, either as a single remedy or as an auxiliary remedy. I regard electricity in general and static electricity in particular as standard remedial agents, and well worthy the esteem of practitioners, whether general practitioners, or specialists of any department in medicine.

“I have often heard the criticism made that ‘electricity in medicine is a humbug,’ and ‘electricity won’t cure anything’—criticisms of course which merit no reply, and the fact is that most of such criticisms are made by men who know nothing about it: and, in fact, couldn’t explain the difference between galvanism and induced electricity.”

The following clinical reports are from the records of W. J. Morton, M. D., of New York. He made the observations himself, and reported them to the New York Academy of Medicine. He is reliable authority everywhere: and, so far as our experience goes. Dr. Morton’s observations are confirmed:

“CASE I.—Mrs. K—, seventy-two years of age, hysterical spasm. This lady applied to me for advice two years ago, but I was not able to afford, notwithstanding persistent and various medication, the least relief. Despairing of curing her, and considering the case interesting, I obtained her consent to going before the meeting of the American Neurological Association, in June, 1879, from whose records I extract a few lines describing her condition: ‘Dr. W. J. Morton presented a patient who for many years had suffered from sudden attacks of great distress, both mental and physical, attended by apparent eructations of immense quantities of wind. The seizures lasted from one-half to one or two hours, during which the patient was greatly distressed. The attacks were developed by any form of excitement. They were in no way related to dyspepsia. None of the members had seen a case exactly like it. Nothing in the way of treatment had afforded any benefit.’

“Mrs. K— has been subject to these attacks daily for twelve years; she attributes their origin to emotional troubles. The attack is usually ushered in by a tired feeling and much apprehension. At the same time she generally feels nausea. They are most often brought on by surprise, a question, or a variety of slight causes, though frequently occurring without any known exciting cause. Their onset has no relation to the food she takes. Shortly following the sense of weariness succeed excruciating pains, first in the wrist and fingers, then in the

elbows, and up the arms. She at once begins to rub these parts in great distress; the pains soon reach the knees and feet; a sense of tickling begins in the throat, which quickly becomes tense and rigid, and creates a sense of suffocation; finally there is severe pain between the shoulders, the patient now presenting a case of greatest distress. The muscles at the articulations named are tensely contracted. The order of events described is sometimes varied by the origin of the attack in the face, alongside of the nose, and in the teeth and gums. Suddenly the patient's distress is in a degree relieved by what appears to be a great belching of wind from the stomach. This phenomenon I cannot explain. A feather held at these times before the mouth is neither drawn inward nor blown outward. There is, therefore, no real belching. The sound more nearly resembles that of cribbing horses or the grunting of certain fishes. The attacks break up with profuse involuntary lachrymation. Such an attack often lasts two hours, and occurs several times daily. She believes that under such circumstances life is a great burden to her.

“ I will not further enlarge upon her symptoms. Unable to relieve or cure her, I had abandoned the case. Returning from Europe this summer, she again called, and stated that she was much worse.

“ As a last resource I suggested static electricity, with the following history:

“ November 16th. Insulation, half hour, and sparks at epigastrium. November 18th. No spasm since insulation; yesterday was the first day for twelve years that she had passed without an attack. Insulation, and sparks to spine. November 22nd. No attack since last record. Feels perfectly well. November 23rd. Pain in the arms and between the shoulders was beginning when she mounted the insulating platform; this disappeared in ten minutes. Nov. 24th. A slight spasm yesterday, with pains. Nov. 27th. No further attacks. Treatment thrice weekly was continued during December, with no returns of attacks. January 7th. To-day fell on the ice, which brought on severe attack of pain in the epigastrium, arms and legs, and suffocation, the whole lasting about eight hours. From this date treatment was continued two weeks, and the patient was then entirely cured. No other form of treatment was made use of. No appearance of return has occurred to date.

“ It need hardly be said that the sudden cessation of the misery of years was equally gratifying to physician and patient.

“ *CASE II.—Hysterical Spasm and Paralysis.*—Mrs. M—, aged twenty-six; married seven years; three children; no neuropathic history.

"Present trouble began three years ago last June. While walking noticed something like a flame before the eyes, then her sight failed her, her arm and leg grew heavy, her tongue thick, so that she could only sputter, but she in no wise lost consciousness.

"She laid in bed eleven months, paralyzed in the *entire* left side. The face was flat on the left side, and drawn to the right; the leg, arm and hand were numb, but also were subject to stinging, prickling pains; her face and lips also prickled; had *globus hystericus*. Though she left her bed at the end of eleven months, she has never been well.

"*Present Condition.*—Attacks occur daily. The whole left side suddenly grows numb and heavy as lead. At the same moment the leg shortens, the arm also shortens and retreats up the cuff of her dress, the tip of the shoulder mounts nearly to the left ear, while the whole left side of the face is in the condition of facial spasm. At the same time the throat constricts, and the jaws are set in a complete trismus. She can now neither speak nor eat, though suffering little pain. She is often obliged to have her food, in the form of soup, administered through an opening in the mouth produced by a former extraction of a molar tooth.

"These daily attacks often continue three or four hours. They come on suddenly. Sensibility on left side, at times anaesthetic, at times hyperaesthetic. The phenomenon of *transfert* may at any time be produced. Left eye amblyopic and achromatopsic. Left side of tongue has no sensation of taste. In short, the complete sensitivo-sensorial anaesthesia described by Charcot exists. Dynamometer, during attack, left hand, 5; right hand, 36; out of attack, left hand, 25; right hand, 36.

"*Treatment.*—December 29th. Insulation, positive charge for half hour, sparks to left side; transfert soon effected. December 30th. Same. December 31st. Now no limp in left leg, while the arm also is more manageable. The daily facial spasm and trismus has not returned. Normal sensation on left side, with the exception of a numb area over the deltoid and on the dorsal aspect of the forearm. Dynamometer, left hand, 38; right hand, 40. January 4th. But one attack now for four days. Treatment same. January 7th. No further attacks; only remaining trouble is a slight stiffness about the neck, and a tendency to blepharospasm. Appetite excellent. January 8th. Slight attack of facial spasm. January 13th. Says she is perfectly well. Treatment, insulation and sparks to spine. January 15th. A slight twitching about the right eye; this is the first motor trouble on this side. January 16th. Again a slight attack; left side of face feels stiff, and its muscles are a little

drawn. These symptoms can always be relieved by pressure on the facial nerve. January 23rd. One severe attack. Face much drawn, and stiff. Left side very anæsthetic, and cold to the touch. Temperature, surface of left arm, 75; right arm, 88. Insulation for twenty minutes. Oscillations of temperature and sensibility first took place, with finally transfert of anæsthesia to the right side, followed by hyperæsthesia in the left. The temperature was now stationary at, left arm, 95; right arm, 90. January 27th. With daily insulations, and sparks to the spine, all signs of attack seem now to have ceased. March 2d. The patient has been under treatment during February, with but now and then the slightest admonitions that she is not yet completely cured. But the great change in her condition, from three to four hours of helplessness to almost complete health, justifies this much abbreviated report of her case.

“CASE III.—December 2d 1880. Miss C—, twenty-three years of age. Muscular rheumatism. Subject to rheumatism for ten years. Began with an attack of acute articular rheumatism. Scarcely a week during the last five years but she has felt pain in some part of her; frequently as a “stiff neck;” had sciatica for one year, and walked with a cane.

“Present condition began eight months ago, though worse during last few weeks. Has pain and feels stiff in the neck, back, legs and arms. Every movement occasions great pain. She is, in short, crippled. Each morning she must be raised from bed, but in several hours she is able to get about better than at first.

“*Treatment.*—Positive insulation, and slight sparks. Patient improved with each day’s treatment. December 6th. All pains had disappeared, and patient for the first time in many months walked freely. December 7th. After over-walking, suffered again from a moderate general lameness in the muscles. December 10th. Every vestige of pain disappeared. Appetite much improved. Though so well, patient was so fearful of a return of pain that she continued treatment up to January 7th, when she discontinued it, satisfied that the cure was absolute. Up to date, nearly two months ago, no return has occurred. No other treatment was used. A number of cases of rheumatism may be alluded to very briefly.

“CASE IV.—December 15th. Mrs. B—, thirty-four years of age. Pain in both shoulders to such extent that she never raised the arms; deltoids and trapezei chiefly affected; also pain in right hand; this condition existing very steadily for three years.

“*Treatment.*—Insulation and sparks; one application. Pain has never returned.

“CASE V.—December 6th. Mrs. J. B. F—. After sitting

in the draft from a window one year ago, pains began in the right arm and shoulder. At present does not raise her arm on account of pain in the shoulder-joint. Has also pain in the wrist and in the joints of the fingers, some days in one joint, some days in another. The arm feels 'woolly,' *i. e.*, anæsthetic, and heavy. Insulation and sparks. Complete relief in twenty minutes, with no return to date.

"CASE VI.—Mr. U—. Chronic rheumatic pains and stiffness in both shoulders. During the entire winter it has been impossible for him either to raise the arms at the shoulders or put them behind his back.

"Treatment.—Insulation and two inch sparks. To the patient's great surprise, he was able, after five minutes' application of the sparks, to throw his arms about freely in every conceivable direction. No pain or impairment of motion remained. The result was surprising also to a number of physicians who were present.

"CASE VII.—December 31st, 1880, Miss R—, twenty-two years of age. Pain in the left biceps; also in elevator muscles of left scapula. Unable to use left arm, and suffering much with it during the last month.

"Treatment.—Insulation and sparks. Relieved by the first application of every vestige of pain, and enabled to use the arm freely. No return to date. It would be wearisome and needless to quote more of these cases from my record-book. I have known no instance of failure to completely relieve in from one to ten insulations all cases of muscular rheumatism. Lumbago of long standing seems to require patience for one, and, to ensure entire recovery, perhaps two weeks.

A single instance of sciatica and cruralgia will suffice for all.

"CASE VIII.—December 11th, 1880. Mr. H—, twenty-eight years of age. Begun three years ago. Subject to severe attacks of shooting, throbbing pain in hip, thigh and extending to the toe, lasting generally three or four weeks. He walks lame, seldom sleeps more than an hour at a time during the night without waking up in pain. During the last week, in addition to a painful sciatica, he has had great pain in the line of the anterior crural nerve, extending as far as the inside of the knee. Medicines and a great variety of liniments have given no relief.

"Treatment.—Insulation and very severe sparks (three inches), since patient was perfectly willing to take them. December 12th (next day). Patient reports that he had had no pain since leaving the office, that he slept well, and now walks without lameness. Up to date no return of trouble.

"CASE IX.—*Bell's Paralysis*, right side.—Mr. F—, medical student, twenty years of age. Referred to me by Dr. Ham-

mond. January 1st, 1881. Patient, after walking in a very cold wind on December 19th, noticed the next morning that his face drew to the left side. The next day he could not close the right eye, and on examination found that the whole right side of his face was paralyzed. Faradic electricity and strychnia had been used up to January 1st, with no effect. He accordingly wished to try the static electricity. At the time of beginning treatment there was no possible voluntary motion on the part of the muscles supplied by the facial nerve. Water ran out of his mouth, and food lodged between the cheek and teeth.

“Treatment.—Each muscle was singled out and treated by sparks, and also the trunk of the facial nerve.

The patient writes: ‘After the third insulation there was a marked improvement in some of the muscles each day, and after the seventh my face was entirely straight.’

“CASE X.—*Bell's Paralysis*.—January 7th, 1881. Mrs. A. —, aged forty. Absolute right facial paralysis, of two months' standing (untreated). Right eye open and staring and much inflamed; saliva flowing from right angle of mouth, and other symptoms usually seen in these severe cases.

“Treatment.—Insulation and sparks. January 8th. Can now very nearly close the eye. January 9th. Buccinator less flabby; eye closes. January 14th. At the end of the seventh application all the paralyzed muscles had recovered their proper action with the single exception of the occipito-frontalis. I continued treatment two weeks longer, hoping to restore this muscle, but was unable to do so. Its nerve-supply is apparently irreparably injured, owing probably to the two months' neglect in treatment.

“CASE XI.—*Pressure Paralysis*.—Mr. A. D.—. One week previously went to sleep with his arm thrown over the back of chair. On waking up found his arm paralyzed; it was numb, heavy, and pricking, as if asleep; he could not hold objects in his hand. To tests of sensibility there was anaesthesia; dynamometer, right hand, five; left hand, sixty.

“Treatment.—Insulation and sparks. After the fifth application the arm was cured.

“CASE XII.—*Progressive Locomotor Ataxia*.—The early diagnosis of locomotor ataxia carries with it a promise of cure directly in ratio to the accuracy of the diagnosis and the immediate application of remedial measures. November 24th, 1880. Mr. A. L.—, aged sixty. During the last year patient describes very accurately the symptoms common to pre-ataxic or neuralgic stage of locomotor ataxia. He is now just entering upon the ataxic stage. Present condition: shooting, stabbing pains in the legs, occurring in paroxysms, particularly preceding

changes in the weather. The same pains sometimes occur in the arms. Patient often rolls in agony on his bed during a paroxysm of several hours, and though a strong man, the pain is such as to bring tears to his eyes. No spot in his legs seems to be free from these pains, though they are worst in the thighs and great toes. The exclusion of simple sciatic pain was clear, especially as the affection is bilateral. The patellar tendon reflex is absolutely abolished at the left knee, and but a very weak response can be evoked at the right. The vesical and rectal reflexes are also much diminished. Urination and defecation are both slowly accomplished and difficult. Sexual power is absolutely abolished. No strabismus or ptosis, but diplopia has existed for two years. The reaction of the pupillary reflexes is diminished; carefully tested in shade and light they showed but little normal response. The patient seems to be just entering upon the ataxic stage, for he walks with a heavy cane, complains that he does not feel the ground well, particularly on the sole of the left foot; cannot walk in the dark without retaining his hold on the wall or banisters, and exhibits the usual swaying with closed eyes.

"The whole group of symptoms, fulgurating, bilateral pains, abolished reflexes, and ataxia, render the diagnosis of locomotor ataxia perfectly clear.

"I found the patient in a paroxysm, and prescribed the usual remedies, proposing that the next day he should begin treatment by electricity.

"*Treatment.*—The treatment was simple and offers little variety in the records. It was insulation and heavy sparks from the spine, continued daily, from November 24th to December 23d, in all twenty-two applications. The pains disappeared at the end of the tenth application. The patient returned to his home cured of his ataxia and of his pain.

"In a note written ten days ago, nearly two months and a half since his return home, he says: 'I now walk perfectly well, and have had no pains, not even a twinge, since my return home.'

"With these few cases briefly synopsized, I leave this part of the subject.

"I am well aware of the value of statistics, and shall take occasion to collect them as soon as is possible. For the present I am obliged to select from the records of private practice only a few typical cases of a form of treatment which I have only lately employed.

"*First.*—Static electricity as a curative agent in medicine may fairly be placed on a level with galvanism and faradism. In certain diseased conditions it is superior to either. Cases I., II., III., etc.

“By insulation and sparks, paralyzed muscles and nerves are stimulated just as by induced currents.

“*Second.*—The main objections to static electricity are based upon the inconvenience, the working uncertainties of the apparatus, and the difficulty of measuring and controlling the electricity administered.

“These objections fail to have weight with the use of a modern improved Holtz machine, and a proper electrometer.

“*Third.* Insulation and sparks, both or either, more notably sparks, relieve cutaneous anaesthesia more quickly than galvanism or faradism. In hemiplegia with organic lesion, numbness and anaesthesia is at once relieved by this treatment.

“*Fourth.* Decided motor improvement may be obtained in hemiplegia of long standing. The dragging of the toe, the tread on the outer side of the foot, the outer swing to the leg, the rigidity at the knee, elbow and shoulder, may all be to a very apparent degree and often entirely removed.

“The contracture at the wrist and fingers is incurable.

“*Fifth.* In paraplegia and systemic diseases of the spinal cord in general, there is every reason to expect that by means of long and strong sparks to the spine that results not now attainable may be reached. Case XI.

“A distinguished and careful observer, familiar with the treatment by sparks, thinks that ‘patients suffering from paraplegia who are now benefited by the constant current were previously cured by static electricity.’

“*Sixth.* In the sense that medicines are tonic, the positive electrical insulation is tonic.

“*Seventh.* Statical electricity by insulation and sparks is principally useful in conditions of paralysis, spasm, and neuralgia, and pre-eminently in subacute and chronic rheumatic affections, whether tendinous, facial, or muscular.

“*Eighth.* Static electricity cures disease, as other forms of electricity do, by stimulations of nerves and muscles, organs, and nerves of special sense. It likewise cures, by aid of the spark, in virtue of a sharp, deep, mechanical agitation of the diseased tissue, acting in this instance like physical exercise and massage, by causing alteration of nutrition.

“But above and beyond these methods of curative action is the principle, as lately established by Brown-Séquard, of reflex action in remote parts by peripheral irritation of the terminal distribution of the sensory nerves. In electrification by insulation electricity of high tension is actively accumulating on and beneath the skin, *i. e.*, the nerve distribution, and as actively discharging: the effects of static electricity are then in this instance produced from the periphery; and, owing to the fact that

the electrification is general and the tension high, no other form of electricity offers equal promise in the treatment of diseases or conditions that can be affected either in a sedative or stimulating manner from the general peripheral nerve-distribution. The recent experiments of Brown-Séquard lead us to believe that many diseases may be thus acted upon.

"Ninth. The invention by the author of a method of obtaining an interrupted static induction current from a frictional electrical machine adds to medical electricity a new and practical means of electrical treatment. This current is more agreeable in its administration than ordinary induction currents. Both nerves and muscles are stimulated by it to a higher degree than is possible by means of any other induction current now in use, and a corresponding advance in the efficacy of electrical therapeutics in these two directions may be confidently expected.

"The new current, furthermore, greatly enlarges the scope of statical electrical machines in medicine by combining in a single machine all the advantages both of static and induction electricity."

These observations all refer to experiments with machines already described. On the following page, Fig. 33, we present an illustration of a new static machine, and in connection with its description instructions for its use are given, which, upon the whole, do not differ much from the methods already described. The positive and negative are a little more clearly pointed out, and the manner of insulation and drawing sparks presented in a little different style. This variety detracts nothing; in fact it is a real addition, for some will prefer one method, while others will adhere to another. Indeed, the same practitioner will be entertained, and his practice will be better sometimes, by the adoption of different methods in these experiments.

ATKINSON'S TÖPLER ELECTRIC MACHINE.

The machine we here illustrate and describe is Prof. P. Atkinson's Töpler Electric Machine, referred to by Dr. Romaine J. Curtiss, on page 110.

This machine is manufactured and patented by P. Atkinson, A. M., 168 Randolph Street, Chicago, Ill., and we can recommend it from actual experience. In fact, it gives us pleasure to present an illustration and description of such a valuable instru-

ment. Prof. Atkinson clearly describes this machine, and details its mode of action, as follows:

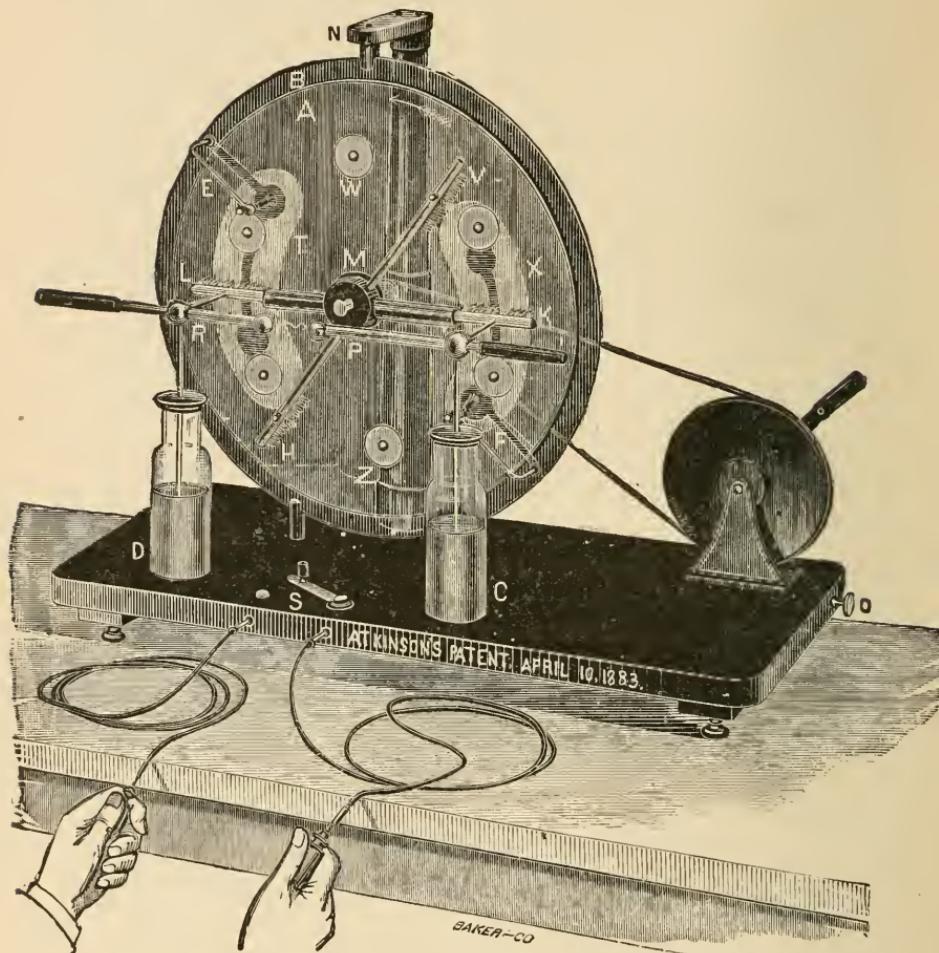


Fig. 33.

"This machine is constructed with two glass plates; the back plate B, stationary, and supported by hard rubber insulators, while the front plate A, placed at a distance of about $\frac{1}{4}$ inch from it, revolves in the direction of the arrow, on an axis attached to the post at M, through an opening in the centre of the plate B.

"To the plate B are attached the brushes E and F, and the tin-foil and paper inductors T and X.

"In front of the plate A, $\frac{1}{4}$ inch from the glass, are the uninsulated combs V and H, with their brushes; and the insulated combs K and L, connected with the Leyden jars C and D, and the sliding rods P and R. V and H are screwed to a brass core at the centre of the hard rubber disc M.

"To the plate A are attached the six discs, or carriers, two of which are seen at W and Z.

"These parts, with a driving wheel and belt, mounted on a base, constitute the points of resemblance between this machine and others of the same class. The points of difference, covered by patent, are as follows:

"1. The outside coatings of the Leyden jars C and D are of sheet brass, nickel plated, and are screwed firmly to the base, forming cups into which the jars fit closely, and are thus held in a fixed position, affording a firm support to the parts connected with them, and preventing liability to accident or injury to the jars or plates.

"2. The induced current from these outside coatings is conveyed down by the brass screws which attach them, and along copper wires underneath to the terminals of the switch S, through which, when closed, it passes from one jar to the other; but when open, as in the cut, it passes by the brass sockets, seen on the edge, which are also connected with the terminals, out through the conducting cords, and a person, or other object, connected with their outer extremities. As this induced current flows simultaneously with the direct current from the inside coatings, the switch and sliding rods place it completely under control of the operator, either for medical or scientific purposes. With the switch open, a slight separation of the electrodes or discharging rods P and R, produces a smooth, gentle current; this may be increased to any desired strength, a separation of $\frac{1}{2}$ inch producing a current too severe for the strongest nerves. Geissler tubes, attached to the cords, show the beautiful effects of the interrupted current. Also the induced spark below, simultaneous with the direct spark above, is shown when the switch is open about $\frac{1}{2}$ inch, as in cut.

"3. The brush holders E and F are attached to the plate B, through holes near its edge; thus giving a direct passage to the electricity from the carriers on the plate A, where it is generated, through the glass, to the tin-foil inductors, represented by the dark shade, and the paper inductors T and X, represented by the light shade. By passing the electric charge *through the glass, inside its edge*, an insulating margin is interposed between the conductors and the edge, thus preventing loss from leakage, which is unavoidable when the brush holders are attached by clamps or ears *on the edge*.

“ 4. The carriers on the plate A are of sheet brass, with raised centres, and nickel plated, making them both durable and ornamental. The hard nickel surface is not affected by the action of the brushes, or the electricity, while tin-foil soon becomes defaced; and the carrier, being practically one piece, and its entire surface cemented to the glass, its raised centre cannot become detached, as may happen when the centre is put on separately over a tin-foil base.

“ 5. The combs V and K, also H and L, radiate at an angle of 45 degrees to each other, from the central disc M, to which they are attached; so that any possibility of error in regard to their position, or of displacement, is practically impossible.

“ The following improvements may also be noticed:—

“ The base is made of two-inch strips, glued together lengthways, and heavy cleats screwed on underneath; giving all the advantages of iron as to freedom from warping, with the insulation and elegant finish of the wood.

“ The iron casting, on which the driving wheel is mounted, slides in grooves on an iron plate, and is moved by the adjusting screw O, to tighten or loosen the belt.

“ The hard rubber insulators, which support the plate B, have soft rubber packing, to ease the pressure on the glass.

“ The Leyden jars C and D, have wooden caps, with cork attached, making a neat ornamental cap, and affording a firm support to the brass conducting rods which support the sliding rods P and R, and the combs K and L.

“ The machine, as here described, has only two plates; but the number is not limited; four or more plates may be used if desired, but better results have been obtained by increasing the size, rather than the number, of the plates. Plates 16 and 18 inches diameter, respectively, make a very efficient machine; plates 25 and 28 inches diameter, as on the machine furnished to Prof. Pitzer, make one of great energy; and the smoothness of the induced current is very perceptible in machines of large size.

“ The energy of the discharge depends chiefly on the size of the Leyden jars, as increased size gives increased storage, and consequently, greater energy and less rapidity of discharge.

“ *Its Mode of Action.*—To comprehend the action of any electric generator, the following essential principles in their construction should be kept distinctly in view:

“ To generate electricity, is to create a difference of electric potential; the efficiency of all generators, whether batteries, dynamos, or glass plate machines, depending on the difference of potential which each is able to create and maintain within the apparatus itself. And the work to be done by such an apparatus is the restoration of equilibrium, through an exterior circuit;

and may consist in producing heat, light, chemical, mechanical, or physiological action.

“ Let us consider how these principles apply to this machine.

“ It will be seen, from the cut, that as the plate A revolves, the raised centres of the six carriers are brought in contact with the wire brushes attached to the holders E and F, each opposite pair touching opposite brushes, successively, at the same instant.

“ The friction generates electricity, which diffuses itself over the carriers on A, and the inductors on B, with which they are, at the instant of contact, in electric connection. The potential of carrier and inductor, during contact, will be the same; at the next instant the carrier passes on, and is insulated from the inductor, and carrier and inductor now act inductively on each other, and multiply the initial charge given by the friction of contact. As it accumulates it spreads over the paper inductors; these act on the opposite surfaces of the glass, till both surfaces of both plates become charged; the initial charge being still continued by the constant friction of the carriers and brushes.

“ But, since both sides of the machine are of precisely similar construction, and since the mode of action on both sides is apparently the same, the question arises, how any difference of potential, or electric charge can be accounted for.

“ At first, it will be noticed, that the position of the plates being vertical, their lower halves are nearer to the earth, by their semi-diameter, than the upper halves, and consequently more under the influence of its inductive action, by the square of that distance. A horizontal, or any other position, would not prevent this result; it could only be done by placing them between two worlds of equal size, and equally distant from both.

“ The lower halves are also in close proximity to the Leyden jars, the driving wheel, and the belt, and subject to their inductive influence; and the plate B, is supported below on *two* hard rubber insulators, while the upper half has but one, and hence has the advantage of the better insulation of the air.

“ To this lower half of B, and subject to these influences, is attached the brush holder F, while E is attached to the upper half, and remote from them. Hence the carriers brushed by E, and descending towards L, must acquire a higher potential than those brushed by F, and ascending towards K.

“ An accumulation of electricity must also occur at the lower ends of the inductors T and X, from the inductive influence of the earth; and as the brush holder F, is placed at the lower end of X, it furnishes an outlet to a portion of this charge, as seen at night by the brushes of light from this holder to the outside of the jar C, and other parts in close proximity.

“ The lower end of T, on the contrary, is well insulated;

hence, the potential of T, from the heavier charge at its upper end, and the better insulation at its lower end, must be much higher than that of X, where the influences are just the reverse.

" This accumulation, or high positive potential at the lower end of T, must produce a high negative potential at that point on the plate A, and its carriers, as it revolves; and this is shown by the brush of light marking the flow of electricity to the plate from the uninsulated comb H; the outflow of the current received through V from the opposite side and upper half of A. This brush of light extends upward, as the charge increases, almost to the comb L, showing the high negative condition of the plate and carriers, after having parted with their electricity through L to the jar D.

" And here let it be noted, that a brush of light between comb and plate would have the same appearance whether the flow were from comb to plate, or from plate to comb. Hence, a similar brush extends upward from the comb L, as the plate and carriers descend charged from E, and give off their electricity to L.

" Following any opposite pair of carriers, as W and Z, we find that as Z passes under the brush F, W passes under E; and as Z moves on to the insulated comb K, W at the same instant arrives at L; but W, as already shown, has a higher potential than Z, and, at this point, a peculiar adjustment takes place. W gives up its charge through the comb L, to the inside of the Leyden jar D. This creates a positive charge on the inside of D, which induces a negative charge on its outside. The electricity thus repelled, passes to the outside of C, making it positive, and inducing negative on its inside; and this repelled electricity flows through the comb K to the carrier Z. Z then passes on with a positive charge to the uninsulated comb V, while W, having become negative, as previously shown, arrives at H. Each now passes under the wire brush attached to its respective comb, and the combs being attached to the brass core at the centre of M, the carriers are put in electric connection with each other, and their potential equalized by the flow of electricity from V to H; so that each arrives at the original position of the other at the same potential, ready to repeat the same process.

" The combs K and V, L and H, have also performed the same office for the several sections of the plate A, as it has passed them; so that the section from V to E is now at the same potential from centre to circumference, as the section from H to F; each section having, like the carriers, performed its work on the Leyden jars.

" The section from R to H having given up electricity, has

become negative, while that from K to V, having received electricity, has become positive.

“ This positive potential on the front surface of A, at this point, induces negative potential on its corresponding back surface; positive on the front of B, and negative on the back and on the inductor X. In the same way, but in reverse order, similar conditions occur on the opposite side.

“ It will thus be seen, that while the brushes F and E act as generators, the brushes V and H act as dischargers; and while the combs K and L create a difference of potential in the jars, the combs V and H, like their brushes, discharge, and restore equilibrium.

“ When the difference of potential between the inner coatings of the jars becomes sufficient to overcome the resistance of the air, a discharge from the inner coating of D to that of C takes place through the sliding, electrodes or discharging rods, R and P; and, at the same instant, a discharge from the outer coatings takes place through the switch and connections, from C to D, to restore equilibrium between them, and thus complete the circuit.

“ A spark and snap, from the resistance of the air, accompanies the discharge between the inner coatings; and the same will occur between the outer coatings if the switch is open; but if closed, the discharge takes place silently. The plates and other parts being, at the same instant, relieved of strain, there is a restoration of equilibrium in the whole machine.

“ The above explanation applies to the machine when it is put in operation from a state of absolute rest; but when it is in a high state of activity, there frequently recurs a reversal of potential after a discharge, as shown by the reversal of the brushes of light from the combs. To account for this it must be considered, that after the primary discharge a residual still remains; this, from unequal resistance, may be greater on one side than the other, and after being relieved from strain by the primary discharge, will operate to give a slight preponderance of potential to that side, which is rapidly multiplied by induction, as the rotation of the plate continues.

“ A reversal can also be produced by touching the inductors, or parts connected with them, while in action, which would reduce the potential at that point. Special conditions may also exist in certain machines, which will reverse the ordinary mode of action; as, for instance, a difference of thickness on opposite sides of a glass plate; or in opposite jars.

“ The condition of the air, as to its insulation, influences the whole operation of this machine. An air space insulates the plates, and also the jars, with their rods and balls, from each

other; and as a damp atmosphere lessens this insulation, it will decrease the energy of the machine in like proportion. A film of moisture, settling on the plates, will often so reduce the insulation, that the slight initial charge by the action of the brushes is conducted over the damp surface as fast as it is generated; so that no difference of potential, and consequently no charge, can occur. And as the machine is much more sensitive to such influences than the operator, the latter is often puzzled to know why it will not generate. The simple and effectual remedy, in all such cases, is to dry it. This may be done by a fire, a kerosene lamp, a hot iron, or the sun's heat, though artificial heat is generally more effectual.

"Bright, warm, sunny days, before or after rain, when the atmosphere is loaded with moisture, are the most unfavorable. At such times the plates should not only be dried, but warmed, as moisture will continue to be deposited so long as they are colder than the air.

"From this it is easy to see why a Holtz machine is so much more liable to stoppage than a Töpler; as the Holtz receives only a small initial charge, which is then discontinued, while that of the Töpler is constant, from the continuous action of the carriers and brushes: so that a well constructed Töpler is perfectly reliable in any kind of weather.

"The views here given are not mere theory, or hasty deductions from imperfect data. They are the result of constant, daily experiment and observation, for several years, with both Holtz and Töpler machines, of almost every conceivable style, size and variety, including a large number of the very best machines in use."

On page 100, is illustrated and described a static machine furnished by James W. Queen & Co. While this is a good machine, and does good and satisfactory work, the Atkinson machine, for working purposes, is just as good, more powerful because larger, and is far more durable, less trouble to keep properly adjusted, and, all in all, gives perfect satisfaction.

In practice, we handle this machine and make the applications almost the same as with the Queen machine. The most important difference is shown in the switch between the Leyden jars. This, as seen in the cut, is placed between the Leyden jars and in connection with their outer coatings, so that the induced current between them is controlled by the operator. As this current flows at the same instant with the discharge between the sliding electrodes, or discharging rods, connected with the

inner coatings, it is only necessary to separate them to obtain the interrupted induced current, similar to the Faradic.

In connection with the switch are seen cable cords and electrodes, which may be held by insulated handles and applied to any part of the body. Opening the switch changes the current to the cords and electrodes, and on separating the sliding electrodes, or discharging rods, the Faradic effect is at once produced, which may be varied from the slightest tremor to the most violent muscular twitchings, by moving these rods. A separation of 1-16th inch produces a mild, pleasant sensation, $\frac{1}{8}$ to $\frac{1}{4}$ inch becomes painful, while a separation of $\frac{1}{2}$ to $\frac{3}{4}$ inch can hardly be borne by the strongest nerves.

Positive or Negative Alone.—When the switch is closed and the sliding electrodes, or discharging rods, are drawn out beyond sparking distance, positive or negative electricity alone can be administered, by making connection with the ball which surmounts the positive or negative jar. The ball surmounting the jar next the driving wheel in this machine is negative, and the other positive. In the Queen machine, this is reversed, because the plate revolves in an opposite direction.

Insulating the Patient.—This is done on a platform having feet of hard rubber, glass or porcelain. Seated on this platform, the patient can receive a full, condensed charge, positive or negative, as desired, by making connection with the ball which surmounts either the positive or negative jar. This charge may be allowed to escape silently into the air, or be drawn off gradually by points, or the hand, or by sparks.

In order to charge an insulated patient readily and to repletion, it is necessary, as with the Leyden jar, to have some inductive connection between positive and negative. Placing the opposite electrode on the floor, while the patient holds the other, is good enough; or the operator may hold near the patient, by an insulating handle, a large sponge attached to the opposite electrode, and a strong effect is produced. This should not be held so close to the patient as to draw a spark. Twelve inches distant is safe. This is known as the *electric bath*, and is quite agreeable and refreshing to the patient. After the patient has been sitting ten or fifteen minutes, the machine still

running, the imperfect inductive connection may be exchanged for a connection with the earth, by attaching a brass chain, or cable cord to a gas pipe or other metallic substance, leading to the earth. Now, a metallic electrode attached to this brass chain, or cable cord, and held near the patient, will draw sparks.

To be sure, sparks would fly if we should hold an electrode close to the subject while it was connected with the ball surmounting the opposite jar, but this is not so good as using an earth connection. We find it profitable to vary these experiments. The static induced current is far preferable to sparks in some cases; in others, sparks are actually required.

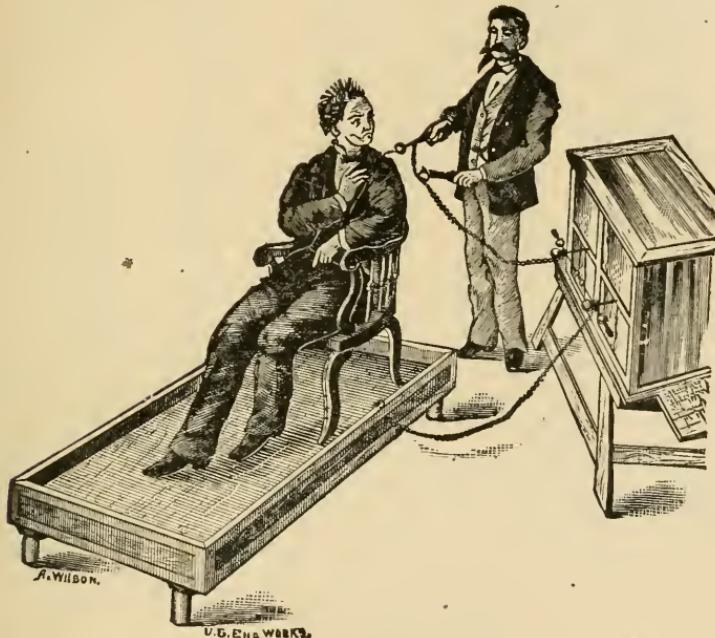
Static electricity is rapidly coming into use, and is regarded as one of the most valuable forms of this force by the leading medical men of this country and Europe. We are glad to be able to contribute something to this branch of medical science.

ELECTRODES ILLUSTRATED.

These electrodes are constructed for experiments and practice with static machines. Illustration 13, on page 124, represents a patient seated upon an insulated platform, which is connected with the prime conductor on the right of the static machine by means of a brass chain. Another brass chain is connected with the prime conductor on the left, is then hooked to a round brass ball electrode, supported by a glass handle, and held in the right hand of the operator. The instrument held in the left hand of the operator is a chain holder, illustrated on page 125 over Nos. 0 and 3. Now if the discharging rods of the machine are separated considerably, and the revolving plate put in motion by turning the crank, the brass ball electrode held near the body of the subject will draw sparks. The nearer the body the more frequent the sparks, and the further away the more powerful the disturbance. In such a case as this the insulating platform is not necessary, for if the patient will take one chain in the hand, while standing on the floor or sitting in a common chair, and the brass ball electrode be pointed at him, sparks will fly all the same. But unless both conducting chains are at-

tached to prime conductors, or one connected with a prime conductor and the other with the outer metal of the Leyden jar, the patient must be insulated, and the brass ball electrode should be connected with some metallic substance connected with the earth—a gas-pipe, for example.

13

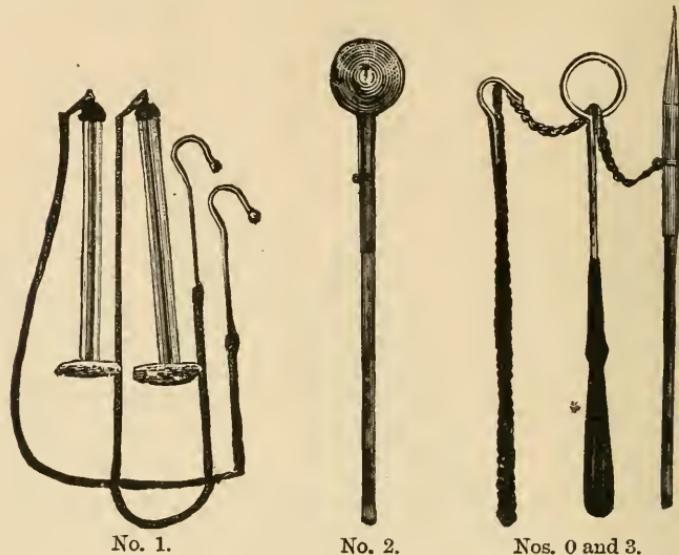


The illustrations over Nos. 1, 2, 0 and 3, on next page, represent one pair of sponges and handles well insulated for the induced static current; a large glass ball electrode, supported by a glass handle; a small brass ball electrode, chain holder and sharp pointed electrode.

The illustration over No. 4 on page 125 represents Morton's spark electrode.

The illustrations over Nos. 5, 8, 9, 10 and 11 on page 126 represent different forms of electrodes used with the static machine, and which have been referred to in previous pages.

These illustrations are from electro-plates furnished by James W. Queen & Co., Phila. We have a full supply of all these instruments, and take great pleasure in exhibiting them to physi-

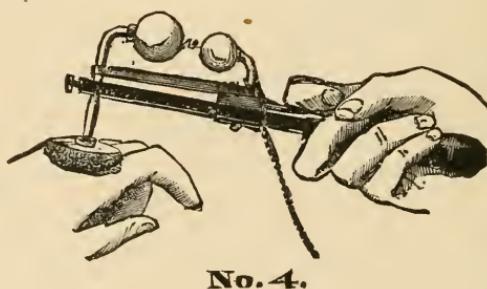


No. 1.

No. 2.

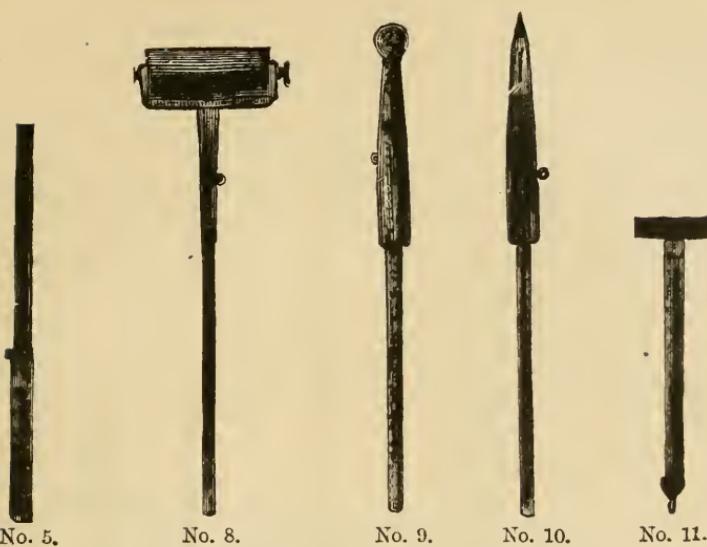
Nos. 0 and 3.

cians who are sufficiently interested in electro-physics and electro-therapeutics to give us a call. While handling these instruments actually furnishes us with first class amusement, this entertaining feature of electricity is the very smallest part to be



No. 4.

considered. In point of real therapeutic value, no agent in existence can take the place of electricity in thousands of cases. What is required is careful observation, study and practice, and



No. 5.

No. 8.

No. 9.

No. 10.

No. 11.

we may afford relief and actually cure many stubborn cases of disease that have heretofore baffled the skill of the wisest physicians of all ages.

These observations and clinical experiences should be sufficient to enable any intelligent physician to apply static electricity when it needed.

STATIC ELECTRICITY AND OZONE.

When a static electric machine is in action and sparks are produced, a peculiar odor is perceived in the room; this results from the conversion of a portion of the oxygen of the atmosphere into ozone, just what takes place in the heavens during a thunder storm. No uneasiness need be suffered on account of any bad results that might come from this peculiar odor, for its tendency is to purify the surrounding atmosphere, drive away infection, brace up and really invigorate those who inhale it. If used for no other purpose, a static electric machine in a house, where it is operated more or less daily, is worth all it costs for the generation of ozone as a sanitary measure.

THE ELECTRO-MAGNET IN EYE SURGERY.

For the purpose of removing small particles of iron or steel from the eye, where they are on the conjunctiva or imbedded in it, or even where they penetrate the coats of the eyeball, the electro-magnet is of inestimable service. Such cases really belong to eye surgery, but general practitioners are frequently called upon by men who work in foundries, manufactories, nail and chain shops, to have "motes" taken from their eyes, and it is very convenient for both parties if we happen to be prepared to render the service required. Some of these cases are very simple, and the foreign substances may be removed readily.

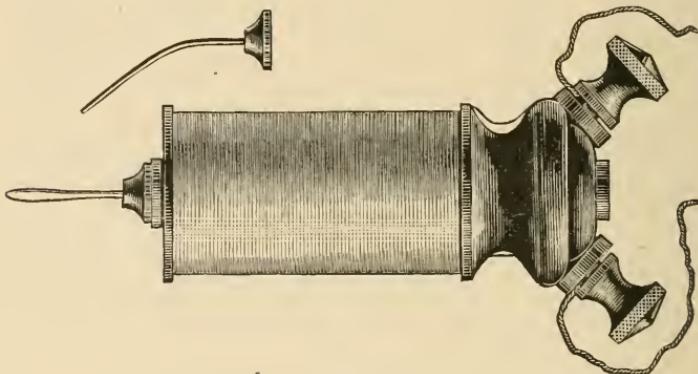


Fig. 32.

with common forceps, or wiped off with any blunt instrument. Other cases, however, may give us much trouble. The iron or steel scales may adhere so tenaciously to the tissues, and be so situated, that their removal with ordinary instruments may be impossible; at least we may be unable to remove them without doing great violence to the eye. It is in such cases as these that the electro-magnet serves a better purpose than any thing else.

The principle upon which this operating instrument is constructed is this: A piece of soft iron is conveniently shaped into an electrode, and before we operate with it, *and while we are operating*, this instrument is included in a galvanic circuit, and thus converted into a temporary but powerful magnet. While in a magnetic condition this electrode is placed upon the

offending scale of iron or steel, which adheres to the magnet, is readily dislodged, and easily removed from the eye by simply withdrawing the magnetic electrode.

Fig. 32 represents a practical instrument for the purposes named. It was designed and put into operation by Prof. J. O. Stillson, M. D., of Evansville, Ind., who has used it very successfully in many instances. We have had our instrument-maker make us one of these electro.magnets for our own use, and its capacity for lifting metals is simply wonderful. Small metallic objects are drawn from quite a distance by it.

This electrode, or operating instrument proper, as seen in the above illustration, consists of a rod of soft iron one-half inch in diameter and three inches long, terminating in a screw-head or socket, to which may be joined at pleasure either a straight or curved point; and for convenience of manipulation, several of different sizes and styles of point applicable to the various emergencies likely to arise may be used with this instrument. Two are shown in our illustration. For small particles upon the cornea, unless deeply imbedded, a blunt point, having a flattened bulbous termination, will be found most suitable.

When contact is effected between the foreign body and the point of the magnet, a distinct tone or metallic noise is heard, faint, to be sure, but readily perceptible, and generally the larger the body the more distinctly the sound.

Cases Reported by Prof. J. O. Stillson.—“I.—R. N., aged 26, smith. While working at his anvil in attempting to cut a piece of cold iron, received a wound in the right eye, caused by a sliver of steel from the chisel.

“When I first saw the patient there was a corneal wound in the upper portion of the low and outer quadrant. The wound was of a linear character, about one-sixteenth inch long, and from without and downwards, upwards and inwards.

“Anterior chamber full, and by oblique illumination a slender piece of metal was observed occupying the lower and outer portion of the bottom of the anterior chamber.

“Patient said that piece had stuck in the eye, and some fellow workmen had attempted to remove it with a silk handkerchief, thereby pushing it into the eye.

“My first impulse was to make an irridectomy, as the foreign body was visible and as the corneal wound was scarcely per-
vious, but as the accident was so recent, I felt justifiable in

attempting removal without harming the iris, and therefore selected the magnet as the best means.

“Having chloroformed the patient, who was extremely nervous and unruly, I enlarged the wound somewhat with the point of a Græfe’s knife, permitting the aqueous to escape. I next introduced the curved point of the magnet barely within the chamber and towards the sharp end of the sliver, which was lying downwards.

“Presently the point of the sliver approached and attached itself to the magnet, the contact being plainly felt, but no sound heard. The instrument was slowly withdrawn, and when the point of the foreign body was well through the cornea, it was seized with a pair of forceps and withdrawn.

“The subsequent treatment consisted of atropine, etc.; and with slight iritis and very little corneal trouble, the patient made a good recovery, leaving a slight cicatrix in the cornea at the site of the wound, but no prolapsus of iris.

“CASE II.—March 15, 1881, J. B., aged 22, file-maker, presented himself for treatment twenty-four days after accident.

“Upon examination found corneal wound one-eighth inch long, slightly above pupil. Aqueous cloudy; iris adhered to capsule in upper outer quadrant; remainder of pupil dilatable with atropine, showing lens in state of swelling and nearly opaque, translucent, with body visible at lower margin of upper edge of pupil; iris apparently transfixated, but point of foreign body, to which iris adheres, not perceptible from above. Upon widely dilating the pupil the iris adheres by a mere thread. Anæsthetic, ether; tension of eyeball greatly exalted; puncture in cornea made with a lance-shaped knife; aqueous ejected from chamber with great force. Oblique illumination reveals situation of foreign body. Introduction of magnetic needle no effect upon the foreign body until magnet was made to touch it, whereupon a slight sound perceptible. Upon attempting to withdraw magnet, contact broken, body remains.

“Second attempt also unsuccessful; but upon making third attempt the adhesion gave way, and the removal was effected as in the preceding case, the last part being facilitated with the use of the forceps.”

Other interesting cases of a similar character are reported by Prof. Stillson, but these are sufficient for illustration. That this is a practical device may be seen at a glance, and it will be found exceedingly useful to the general practitioner, especially if he happens to be located near manufactories or foundries. Where simply upon the conjunctiva metallic substances are removed almost instantaneously with this instrument.

Any style of galvanic battery may be used with this instrument, so it gives a current strong enough to magnetize the soft iron rod of the electrode. One Bunsen cell is amply sufficient. But if we have a Stohrer, McIntosh, Bartlett, or any of the galvanic batteries in common use, we can attach this electrode to any of them, and from four to six cells will be sufficient to operate this electro-magnetic electrode with entire satisfaction.

ELECTRICITY IN SEXUAL WEAKNESS AND IMPOTENCY.

Slight sexual disturbances, and conditions bordering upon a total loss of sexual power, are frequently met with, and we occasionally see a case of complete impotency.

Patients suffering from sexual weaknesses behave quite differently; in fact, the conditions are very unlike in most cases, and a description of one cannot be relied upon as a true history of another. For these reasons it is not safe to prescribe for new cases at a distance. We should see each patient, make a careful examination, and obtain a correct history, if possible, before we prescribe. And in the majority of instances we want our patients of this class under our immediate, daily observation. At least this is the best for a while—till we are certain a cure is in progress, and that the treatment can be carried on at a distance, at their homes, as well as with us.

Men, young and old, married and single, come to us complaining of peculiar troubles, and we frequently find them suffering from a sexual weakness of some kind. They sometimes know the nature of their trouble; occasionally they do not. Some have not the same keen desire for sexual intercourse enjoyed in former days. They sometimes fail in executing or completing the act of sexual congress; or they are over-sensitive, and barely come in sexual contact with the opposite sex when suddenly an imperfect, unsatisfactory orgasm quickly terminates the intercourse, the virile organ at once becoming flaccid and totally incapacitated for further efforts at copulation. In some cases an erection is impossible.

Some of these patients complain of dull headache, suffer from

forgetfulness, pain in the back, palpitation of the heart, dyspepsia, weak or dizzy spells, cold hands and feet at certain intervals, and horrible feelings of impending danger are sometimes suffered. Under such circumstances, the countenance wears an anxious expression, mixed with an appearance of distress and melancholy. Tired feelings, loss of ambition, drowsiness, and yet an inability to sleep, are not infrequent symptoms of sexual disturbances.

Now, the treatment of these cases should engage our serious consideration. Men value the sexual function highly, and an impairment of this kind, especially a condition approaching a total loss of power—impotency—not infrequently leads good men to ruin. They are apt to lose all interest in business, family and friends; are likely to dissipate, and sometimes are tempted to commit suicide. For these reasons, and knowing that we can, in so many cases, completely restore these patients, and greatly relieve others, we urge prompt, radical and persistent treatment in every case of this kind we meet.

So far as relates to the moral and medical treatment of this class of cases, our literature is abundant. Rest, abstinence, temperance in all things, and the judicious use of coca, strychnia, phosphorus, and sometimes the bromides, are the principal means recommended. But in the judicious use of electricity, in the proper form, and rightly adapted to each case, we have one of the most important, if not the very best therapeutic measure now available, in all cases of sexual weakness and impotency in the male. But it must be used with judgment, and applied with a skilled hand. Accidental cures may be wrought by the empirical use of electricity, but, while this may be the case, we should remember that great harm may result in other cases by its unskillful application. Where its judicious employment does not radically cure, it frequently helps materially, and by the aid of other remedies many excellent cures are made.

The proper use of electricity, the particular form and current to employ in each case of sexual weakness, and how to apply them as material and radical means of cure in this class of diseases are the principal aims of this chapter.

Upon this subject, Wm. F. Hutchinson, M. D., of Providence, R. I., in the *New England Medical Monthly*, gives us some practical suggestions, as follows:

"Electricity has been employed for a long time in these cases, until quite lately by charlatans alone, and even in their hands has yielded good results. It is to call attention to a few points, which are perhaps novel in the application of the currents to the generative organs, that this article is written, although the long preamble might easily have led to another opinion. Early in my special study of electro-therapeutics, in 1874, the idea occurred to me that faradism could be applied to the male generative organs in a better way than by manipulation with rheophores or the electric brush. I therefore devised a special electrode, in the shape of a cylinder of metal, within which plays a piston, the rod of which is surrounded by a weak spiral spring, bearing upon the inside of the closed end of the cylinder. Resting upon the piston is a pad of surgeon's sponge. The tubes are made of different diameters, varying from $\frac{3}{4}$ to 2 inches—and from $3\frac{1}{2}$ to five inches in length, and during the operation surround the penis, the sponge pad, moistened with salt water, pressing against the glans. The current should be exceedingly fine faradism, i. e., of rapid interruption, of high tension, and fair quantity. In other words, it should be as strong as the patient can bear without pain and without shocks. Applied in this way, with a large negative sponge electrode at the back, under the lumbar vertebræ, the patient comfortably recumbent, the result is a strong stimulation of those branches of the sacral plexus composing the genito-urinary tract, and a corresponding increase in muscle nutrition. The penis becomes turgid, the dartos contracted, and a close watch must be kept upon the patient, lest, by continuing the application too long, an emission be produced. By discontinuing the current after five minutes, or by increasing the electro-motive force until it becomes painful, this result may be avoided. By a steady persistence for several months in this form of treatment, I have succeeded in rescuing several patients from that worse than death to a sensitive man—a life of lost manhood. The applications should be made daily.

"In cases of nocturnal emissions, a directly contrary course must be pursued, since the conditions are opposite, at least in a certain sense. There is as yet no loss of virile power—there is an intense hyperæsthesia of the genito-urinary tract, which requires no stimulus, which is directly injured by it. No tonics, beyond the general ones of out-door exercise and plentiful food, can be depended upon; for they tend to aggravate the irritation of the excited nerve centers. For this reason, faradism is inad-

missible. I think that far more injury than good has followed its use, and abandoned it wholly in my own practice in these cases several years since. In its place I use galvanism, derived from a battery of low tension—some modification of Daniell's element. It is applied by a Newman's urethral electrode, with olive tip large enough to gently distend the urethra. This is passed into the bladder, and the circuit completed through a hand electrode, when it is slowly withdrawn, the whole operation lasting about one minute. If the slightest pain is experienced, the current is too strong, and should be modified until only a sensation of warmth is perceived. This operation should be repeated daily for several weeks, and has been, in my practice, productive of the happiest results. One case, now under treatment, in the eighth week, reports emissions reduced from three or four weekly to one in eight or ten days."

Dr. C. L. Dana, one of the leading neurologists and electricians of New York City, in the *Medical Record* furnishes us with the following practical points:

"We have, I think, in electricity, an agent by which direct sedation of the over-irritable nerve-centers can be obtained. In a case of irritable sexual weakness with premature emissions, the patient after a few applications of my spinal electrode was greatly improved, though electricity had been tried before for a long time in vain.

"I have here a special appliance for the treatment of sexual nerve-weakness. It was devised by Clemens, of Frankford, and was used upon a most obstinate case of impotence, a case which had been in the hands of many prominent neurologists of New York. The patient rapidly recovered, and is now a new man. This, which I know to be a fact, is my excuse for showing the apparatus, which apparently has a good deal of hocus-pocus about it.

"It consists of a zinc cylinder, made to enclose the penis, with a funnel attached, so that it can be filled with Rhine wine or weak alcohol. The positive pole is connected with it, and the negative pole, which is attached to a very large electrode, is placed over the spine. It is to be used three times a day for five or six minutes, a current of five to eight cells being employed. It is supplemented with a set of magnetic apparatus which seems to be of subsidiary importance. There is no doubt that the patient gets the sedative effects of the galvanic current very thoroughly. I am at present treating a case with it. The patient, who is a very intelligent man, in fact a doctor himself, was very decidedly improved, and is indeed now almost well."

These appliances, as described and used by Drs. Hutchinson and Dana, are certainly effective. We have not used their exact pattern, but have a similar device that, in some respects, we prefer to theirs. We like the results of its use very much. There is something—yes, I will say there is a great deal, in properly localizing electrical treatment.

Prof. Wm. A. Hammond, M. D., in his very excellent work, "Sexual Impotence in the Male," makes some very practical observations regarding the use of electricity, and we take pleasure in making some verbatim quotations from his work. A young man, the first morning after marriage, called upon him, in utter despair, with the information that he was impotent:

"Continual questioning led to the information that his desire had been moderately great, but that his sexual power had been utterly wanting. There had been no erection, or any approach to one, and the result was that after many attempts at intercourse, in the expectation that success would attend the efforts, he had desisted, had gone to sleep, and during the night had had two seminal emissions. In the morning the attempts were renewed, and again without success. * * * * *

"I advised that he should at once occupy a separate room from that of his wife, that for the present no further attempts at sexual intercourse should be made, and that he should stay in New York about a month, for the purpose of such local and other treatment as his case required. This was, he declared, impossible, and he accordingly took his leave, disgusted with himself for the hapless condition into which he had fallen, and with me, and the science of medicine, that he could not be cured in twenty-four hours.

"But on the fifth day he returned, having in the meantime utterly failed to consummate the marriage, and ready to agree to any terms that I might impose which were at all likely to result in a restoration to sound sexual health.

"On my certificate that he was affected with a serious disorder of his nervous system, which required treatment, he readily procured a leave of absence from his congregation, and then he put himself definitely under my care. He and his wife occupied separate rooms in the hotel at which they stopped, and he pledged his honor that on no account would he attempt sexual intercourse till I gave him permission.

"The first thing to do was to arrest the nocturnal emissions, of which he had had one, sometimes more, every night since his marriage. To this end I prohibited sleeping on the back, and

enjoined the use, morning and night, of cold baths, with friction of the whole body after each with coarse towels. He was also to walk at least five miles every day, and to go to some place of amusement of a cheerful character every evening. Internally his food was to be of a highly nutritious character, of which fat in some form or other, preferably cream, was to constitute a large proportion. His dinner was to be taken not later than two o'clock, and a couple of glasses of Burgundy were to be drunk with it. For medicine I prescribed the following: R. Sodii bromidi, $\frac{3}{4}$ i.; pepsin (Fairchild's), pancreatin (Fairchild's), $\frac{1}{2}$ iss; glycerine, aquæ, $\frac{1}{2}$ ii. M. Dose, a teaspoonful in a little sugar and water three times a day after meals.

"My objects in giving this mixture were to lessen the reflex and automatic excitability of the generative system, to relieve the cerebral hyperæmia, and to promote the digestion of food.

"At bed-time he took a capsule of five grains of the monobromide of camphor.

"Every morning I applied statical electricity to the penis and testicles, and to the whole length of the spinal cord, drawing inch sparks from the former organs, and from three to four inch sparks from the spine. This was continued for about fifteen minutes. Though painful the effect was all that could be desired: the blood-vessels of the penis became visibly distended, and the whole organ assumed a deeper red color than it had possessed, as he said, within his recollection. For several hours afterwards a warm pleasant glow was felt in the penis and scrotum.

"Twice a week I applied by means of a urethral electrode a galvanic current from eight cells to the membranous and prostatic portions of the urethra, with the object of diminishing the morbid excitability which evidently existed in those parts. I may say that examination with the sound had previously demonstrated the hyperæsthetic condition of the parts in question. I had at first thought of cauterizing them with Lallemand's instrument, but decided upon the galvanism as being the less painful and equally or more efficacious. In very severe cases, however, Lallemand's procedure is preferable.

"Under this system of treatment the general health of the patient began to improve from the first. The nocturnal emissions ceased entirely on the fifth night. On the first night he had one, but without a dream; on the second, two; on the third, none; on the fourth, one; on the fifth, none, and there were no more while he was under my observation.

"On every night after the second he slept from six to eight hours, and in the morning he awoke refreshed and cheerful. On the morning of the eleventh day he had an erection, which, how-

ever, was due to a distended bladder, but which nevertheless was the first of the kind he had experienced for several years.

"On the fifteenth night he had a lascivious dream in which the usual images did not appear, or, if they did—and upon reflection he was a little doubtful on the point—they were much less distinct than they had been. They were not accompanied by an emission. The next morning he had another erection accompanied by a slight desire, and every morning thereafter while he remained under my care he had an erection, sometimes with and sometimes without sexual desire.

"He had now been two weeks under treatment, and the general results may be summed up as follows:

"Sound sleep every night.

"Freedom from pain or other uncomfortable feeling in the head.

"A strong, hearty appetite, with good gastric and intestinal digestion.

"Cessation of the nocturnal emissions and of the lascivious dreams.

"A return of the matutinal erections, and of normal desire in connection with them,

"Frequently during the day desire with erections. These, however, were not as yet strong, and I continued my prohibition in regard to attempts at intercourse.

"On the fifteenth I suspended the administration of the bromide of sodium, continuing, however, the mixture with the other ingredients unchanged; and in addition I prescribed the following solution: R. Strychniae sulph., gr. j; acidi hypophos, dil., ʒ j; M. ft. sol. Dose, ten drops three times a day before meals in a teaspoonful of the fluid extract of coca.

"I gave this mixture for the reason that I know of no better tonic for the sexual organs, after the abnormal state of erethism into which they get by abuse has been relieved, than strychnia, hypophosphorous acid and coca. It is necessary, however, not to give it immediately before going to bed, as without this precaution it may produce seminal emissions.

"From this time on his condition continued to improve. He had gained over ten pounds in weight, was getting stronger every day and more cheerful, and altogether more normal in his mind. His erections were occasionally tolerably strong, but, as a rule, though he had several every day as a consequence of the very vivid desires which he experienced, they were not yet by any means of natural strength. He was very desirous of going home, being convinced that he could carry on all the treatment but the electric as well there as in New York. This was probably true, but as I attached a great deal of importance to this part of the man-

agement of the case, I declined to give my consent. He had now been under my charge twenty days, and I felt confident that a week or two longer would complete the cure. On the night of the twenty-first day his wife left her bed and got into his, and he, in disregard of his pledge, attempted intercourse, and with a measurable degree of success. I judged, however, that the emission was premature. The next morning he was filled with remorse, and not only renewed his pledge, but promised, in addition, that his wife should go home and prepare the house for his return. This, however, was not what I wanted. I desired her presence, under restraint, as a constant stimulus to him, but I did not want things to be carried to extremes again till he was strong enough to act his part in a physiological manner. There were, I have reason to believe, no further infractions of discipline. On the night of the thirty-second day he attempted intercourse with my partial consent. I knew he would do better if I allowed him to make the attempt with seeming reluctance than if I gave him full liberty to do as he pleased. In sexual matters, as in many others, the desire and the power are stronger with forbidden fruit than with that which can be had for the asking. The end fully justified the means, for he informed me the next morning, with great satisfaction, that I was over careful with him, and that he believed he had done all that could have been reasonably expected of him.

"I then allowed him to go home, but continued all the treatment, excepting the electricity and the nightly dose of the monobromide of camphor. I thought he ought to continue the whole system, with the exceptions mentioned, for three or four months.

"And I warned him in the most solemn manner that, under no circumstances, was he to have sexual intercourse more frequently than once a week for at least a year, and perhaps even longer. More than a year has now elapsed, and I have every reason to believe that he has strictly followed my injunction. He writes that he is determined not to go beyond the limit fixed, that his happiness is complete, and that neither he nor his wife are willing to exceed those moral and physiological bonds which nature has imposed; that she is pregnant, and that they both look forward to the birth of the child as a sign that God has forgiven him the sins and indiscretions of his youth."

Regarding the use of electricity in cases where there is absence of the power of erection, under the heading of "external remedies," we quote from Dr. Hammond as follows:

"*External remedies.*—First among these, and ranking high in the list of remedies, is *electricity*.

"This agent is employed under three forms—Galvanism, Far-

adism, and Franklinism. In using galvanism the only rule in regard to the strength of the current is to bring into action as many cells as will produce a decided sense of discomfort to the patient. The electrodes should ordinarily consist of wet sponges, and the application should be made to the spine, the perineum, the testicles through the scrotum, and the penis.

"In applying the current to the spine, the whole of the vertebral column may be embraced within the circuit, though greater attention should be given to the lower dorsal, the lumbar and the sacral regions. I usually first apply one electrode—it makes no difference which—to the nape of the neck, and then stroke the back over the spinous processes with the other for three or four minutes, using a current strong enough to cause a considerable sensation of warmth and to produce redness of the skin. Then the upper electrode is placed over the middle of the dorsal region, and the other moved slowly down over the parts below a dozen times. The effect of the application is rather unpleasant, than otherwise, and the back continues to feel a sensation of warmth for an hour or more afterwards.

"Then one electrode is placed over the sacrum and the other on the perineum, and both are kept in their position for about a minute. A current of somewhat less strength will be advisable for this application, as the patient will not generally endure one so strong as that used for the spine.

"In making the application to the penis externally, one electrode may be placed on the perineum, and the other on the glans, the latter being removed every five or ten seconds, or the current broken by the arrangement for that purpose on one of the electrodes. Two or three minutes are sufficient for this purpose.

"It is sometimes the case that the impotence depends in a great measure on an anaesthetic condition not only of the glans but of the whole penis. In such a case the electrode should be passed over the whole organ, and the strength of the current should be such as to cause considerable discomfort if not actual pain.

"In those cases in which nocturnal emissions are frequent and the ereethism is so great that emissions take place without erection or on slight provocation, it is sometimes necessary to apply the electricity to the interior of the organ. A special electrode is necessary for the purpose. It is made of some non-conducting material, except at the very extremity, which is metallic and is in connection with a wire running through the instrument and attached to one of the conductors leading from the battery. This electrode is introduced into the urethra, and the metallic point brought into contact with the orifices of the seminal ducts or to

the prostatic portion of the urethra, as the case may seem to require. As a remedy for nocturnal emissions or analogous conditions it is far superior to the cauterization recommended by Lallemand, and far less painful.

“The application of galvanism in this manner is also extremely useful in cases of nervous exhaustion, or in paralysis of the erector muscles of the penis, the accelerator urinæ, etc. In this internal use, the other pole—the sponge electrode—should be applied to the perineum, the sacrum or the pubis, or alternately to each of these regions, so as to send a current through the penis in all directions. The strength of the current need rarely exceed that from four or six Léclanché cells, and it requires to be frequently interrupted to avoid too great a degree of irritation.

“In applying galvanism to the testicles, care should be taken to provide that the current be not too strong, that from four or six cells being generally amply sufficient. Very intense currents cause a good deal of pain and may induce syncope, an accident which has occurred in my own experience. But the beneficial effects of this use of the agent are often very decided, even after the organs have begun to become soft and to enter upon a state of atrophy. The nutrition is improved and a condition of greater firmness induced. With these changes a return to sexual health is often initiated.

“*Faradism* is also of great value in the form of impotence under consideration. Its mode of use is not essentially different from that of galvanism, except in certain respects to be noted.

“In applying the current to the spine, one of the electrodes should consist of the wire brush; the other, a wet sponge is placed high up on the neck, and the wire brush is carried down the spine slowly, the action being repeated a dozen or more times. The operation is a very painful one, but the reflex stimulating action is very decided. The nutrition of the cord is improved, its normal degree of activity restored and the cure of the impotence materially facilitated.

“For the relief of the anæsthetic condition of the glans, which sometimes is a cause of the non-excitability of the penis, one pole, the wet sponge, is placed over the lumbar or sacral region, while the other, the wire brush, is placed on the glans. A mild current is used at first, and this is gradually increased as the patient becomes more used to it, till one of considerable intensity and causing decided pain is reached. The object is to make a marked impression on the terminal extremities of the nerves of the part, and this cannot be done without exciting more or less pain. Two or three minutes are enough for this application, which, however, ought to be repeated, sometimes daily, and at others every alternate day.

"For application to the interior of the urethra the faradaic current is useful, though in general not as desirable a means of employing electricity as the galvanic current. An electrode of the same kind as that previously mentioned is introduced, and being attached to the induction machine a current is passed as in the other instance.

"Faradaic currents employed in the ways referred to should be frequently interrupted. Slowly interrupted currents are of little service, and cause fully as much pain as those in which the interruptions are rapid.

"*Franklinic or Statical Electricity*, though not of such varied uses as the forms mentioned, is still capable of being employed with great advantage, and is, in some respects, the preferable kind to administer. The manner in which I generally employ it when I have decided that it is the variety of electricity most suitable to the case is as follows:

"The patient being seated on the insulated platform, the clothing being unremoved, sparks are drawn by means of a large brass ball from along the whole length of the spine. The effect of this is to procure a counter-irritant action and a degree of reflex excitation which no other form of electricity so safely and effectually affords. Each spark leaves a slight elevation of the skin, and the whole surface is reddened. The penis frequently enlarges under the influence, and if the sparks be drawn from the sacral region, erections will often be produced, even in cases in which they have not taken place for several months under the influence of venereal excitement. By means of a brass electrode enclosed within a glass cylinder perforated at one end, devised by Dr. W. J. Morton, the action can be directed with great exactness.

"This electrode is also admirably adapted for application to the perineum. Indeed it would be difficult to conduct sparks from this region without some such appliance.

"For the relief of anæsthesia of the glans the statical electricity is fully as effectual as galvanism, perhaps even more so. For this purpose I use an electrode, also invented by Dr. Morton, so arranged that, while the sponge extremity is on the body, the spark can be made to pass between two balls capable of being brought close together or separated as may be necessary. In applying it to the glans penis the dry sponge disk is brought into close contact with the organ, and the brass balls being separated a half inch or more, a powerful effect is produced. In several cases I have succeeded, by means of this apparatus and statical electricity, on restoring sensibility to the glans and adjacent tissues when galvanism and faradism had failed.

"On the whole I am quite satisfied that in the several forms of

electricity which I have mentioned, the physician has the most important of all means for the treatment of enfeebled conditions of the generative system. There are other useful adjuncts to be presently mentioned, but they can none of them, or all of them combined, take the place of electricity."

From the above quotations we may learn a great deal about the use of electricity in these cases, what current to use, how to apply it, etc. These authors are all ripe in age and experience, and trustworthy in every regard.

We would call special attention to the last clause from Prof. Hammond. This is one of the most positive and wholesale statements regarding the use of a therapeutic measure that can be made; and we should remember that it is written by an experienced, competent specialist, acknowledged as authority everywhere. And there is much truth in this statement. Electricity has almost unlimited power in working physiological changes, and we are just beginning to learn about its value as a therapeutic measure. When we commenced the study of electricity, we had no idea of the vast amount of good there was to be derived from its judicious, scientific employment. We are more than satisfied, and earnestly commend it to others. And especially do we urge its regular and persistent application, in conjunction with appropriate medication, in all cases of sexual weakness or impotency, for we can accomplish a great deal more in such cases by this combined treatment than we can with drugs alone. Indeed, we can actually restore some men in this way where drugs alone scarcely help. Of course, coca, strychnia, phosphorus, etc., properly used, help us greatly, and, certainly, we have succeeded in making some excellent cures with these and other drugs in combination, without electricity. A preparation known as *Celerina*, composed of equal parts of coca, celery and viburnum, we regard as one of the most efficient, if not the very best prescription we can use, in certain cases of sexual weakness. But, after all, we have in electricity the most potent remedy, and in no case of this kind should it be neglected or omitted, for in some cases it will be found the main reliance. It will help in every case, and always hasten the cure.

STRICTURE OF THE URETHRA, IMPOTENCE, AND ELECTROLYSIS.

Stricture of the urethra is a surgical disease. It may be spasmodic or organic. The contraction may be found in any, or in different parts of the canal. It may be so limited as to attract but little attention, or it may greatly, even completely, obstruct the flow of urine, necessitating surgical interference for immediate relief. It is generally caused by inflammation of the mucous membrane lining the canal, which may come from gonorrhœa, masturbation, or sexual excesses. Strictures are sometimes very troublesome, and may be followed by serious results.

In this connection, we would observe that one of the most lamentable consequences of stricture of the urethra is sexual weakness. Even in cases where the disease is limited, the patient not being aware that he has a stricture, impotency, or a condition bordering upon total loss of sexual desire and power, may be suffered. And in severe and protracted cases of stricture it is not uncommon for the patient to suffer from sexual weakness, if he does not become totally impotent. Any irritation in the urethra, about the prostate gland, in the testes, or even about the anus, continuing for any length of time, has a tendency to weaken the generative function. The reflex action upon the lower portion of the spinal cord results in exhaustion, or a condition called anæsthesia.

Regarding the frequency of urethral stricture, in connection with sexual weakness and impotency, Prof. S. W. Gross, in his great work, "Disorders of the Male Sexual Organs," holds that the most frequent variety of impotence, what he calls "atonic impotence," is generally induced by subacute or chronic inflammation and morbid sensibility of the prostatic urethra, which is frequently associated with stricture; and that these strictures frequently result from masturbation and sexual excesses, as well as from gonorrhœa. Of the one hundred and seventy-one cases of impotency coming under Prof. Gross's observation, one hundred and fifty-nine depended upon urethral disease—*inflammation, hyperæsthesia, or stricture.*

Prof. Gross calls special attention to the fact "that inflamma-

tion of the prostatic urethra bears the same relation to the spinal reflexes of the male that the inflammation of the uterus bears to allied disorders in the female, and that it is a constant source of irritation of the genital nerves which terminate in that locality. An enfeebled state of the lumbar division of the cord and exhaustion of the cells that minister to its reflex functions are thus finally brought about." Some of the cases examined had been masturbators, others had indulged in sexual excesses, while not a few had had gonorrhea. Prof. Gross holds, and this agrees with our own observations, that confirmed masturbation is just as sure to result in urethritis and the formation of a stricture as is gleet. And we are sure that the same thing may result from sexual excesses. Of eighty-two masturbators who suffered from atonic impotence, and of ninety-one who had seminal incontinence—of one hundred and seventy-three in all—examined by Prof. Gross, only twenty-two were free from stricture. This shows the frequency of stricture in connection with and as a cause of impotency. In some cases two or three strictures existed, in others there was only one. In many cases the contraction was near the meatus, but the majority will be found in the prostatic portion of the urethra.

The fact is well established that impotence, in its various degrees—from a slight weakness to complete incapacity—is frequently associated with and dependent upon disease of the urethra. And where this is the case, especially where stricture exists, all ordinary plans of treatment for impotency fail to give permanent relief. We may prescribe coca, strychnia, phosphorus, etc., and apply electricity to the spine and glans penis, and may help the case materially, and but for the urethral disease we might restore the patient, but until the urethral disease is cured we need not expect lasting results.

These patients notice a ropy mucus following the discharge of urine. They may suffer from difficult or painful micturition. Nocturnal emissions, or daily incontinence of seminal fluid, are not uncommon. Sexual intercourse is impossible, or it is unsatisfactory on account of premature emission and sudden relaxation of the virile organ. This urethral disease *must* be cured.

It is a fact that some men suffer from urethral disease, and

even from stricture, and never think about impotency; indeed, they may not be very much weakened, except temporarily from pain. But a sexual weakness is liable to obtain at any time, under such circumstances, and all this makes the treatment of urethral disease, especially stricture, of great importance.

Prof. Gross is an old surgeon, and he treats stricture, as nearly all surgeons do, by the application of medicaments through appropriate instruments, by the judicious use of sounds, and sometimes resorts to the knife. But we are electricians, and prefer electricity in overcoming and curing urethral strictures.

Of course, where the parts are very tender, and a high state of inflammation is present, suppositories containing iodoform, or sugar of lead and tannin, or hamamelis, may be placed in the urethra once or twice a day for a while; and occasionally an opium suppository may be placed in the rectum to relieve pain, lessen sensibility and give rest. But for the radical cure of stricture, electricity is the remedy. No treatment yet devised is so successful in the treatment of stricture—spasmodic or organic—as electrolysis. In spasmodic stricture the faradic current cures by its relaxing power; but the great majority of strictures we are called upon to treat are of an organic character, and require the constant galvanic current—not the faradic.*

From original papers furnished by Robert Newman, M. D., of New York, we glean the important facts regarding the treatment of stricture by electrolysis, as quoted in the following pages. Dr. Newman is reliable authority everywhere, and we take great pleasure in reproducing his reports, putting his methods in permanent form, for they are of inestimable worth. We are applying his treatment successfully, and cannot better present the subject than quote him verbatim:

Dr. Newman defines the specific action produced by electrolysis in the treatment of strictures as follows:

"My experience of its action, after observing it minutely in all its known relations, leads me to name this electrolytic action galvanic chemical absorption, and I depend mainly on the chemical decomposition caused by electrolysis.

"Next, I must define my term 'absorption,' as some may

*See page 55.

object to it as not definite enough, or understanding that it pertains only to the action of lacteals. But I believe I am justified in using the term, as Webster's definition of absorption is as follows: "The process or act of being made passively to disappear in some other substance, through molecular or other invisible means, as the absorption of light, heat, electricity, etc." And such is the action exactly, as we will see hereafter.

"The negative pole acts as a caustic alkali. If increased tension is used, it will destroy tissue, but mildly applied it acts as a chemical absorbent on the altered tissue, and restores the part to its normal condition.

"The theory on which my first experiments were made, has been corroborated by an experience of some years, and proved to me that electrolysis in curing stricture of the urethra is of the most substantial value."

In all electrolytic operations, galvanic batteries with zinc and carbon elements, and an exciting fluid made of bichromate of potash, sulphuric acid and water, are greatly to be preferred; and the elements should be very small, or the arrangement should be such that the elements can be immersed in the exciting fluid to a limited extent—one fourth, or their whole length, at pleasure. Tension, and not quantity, is what we want in electrolysis.

The catheter or instrument used in the treatment of urethral strictures should always be attached to the negative pole, while a carbon electrode, covered with a wet sponge, chamois or flannel, may be held in the hand by the patient. The catheter or operating instrument employed by Dr. Newman consists of a metal rod, over which a flexible catheter is fixed, and cut off at its extremity for the attachment of a metal bulb, which is securely fastened by means of a screw point on the end of the rod. The bulb is egg shaped, about half an inch long, its length proportioned to its diameter. The flexible catheter acts as a perfect insulator, and at the upper or free end the instrument is connected with the wire from the negative pole of the battery.* These are nearly the words used by Dr. Newman.

Regarding the physiological and therapeutical effects of electrolysis on mucous lining, Dr. Newman says:

* These instruments are now kept in stock, ready made, of different sizes, by nearly all electrical supply dealers, and are called electrode bougies.

" In describing the different degrees of quantity and tension of the current, the result of actual observation and experience, the salient points will be perhaps more intelligible if subdivisions be made.

" The contact of the positive pole with the mucous lining by a metal, bulb-shaped catheter, causes great pain. The electrolysis thus applied feels and acts similar to a strong vegetable acid, destroys tissue, and is not easily borne.

" But if the negative pole is used with the same electrode, no pain follows the application, provided the current is not too strong; it thus produces only a sensation of pricking and burning.

" *a.* If a limited electrolytic power be selected and applied by the usual method, the current is gradual and slow in its action, and we observe—

" *First.*—The mucous lining of the urethra is often covered with an alkaline secretion. The electrolytic action coagulates it in a semi-solid mass. The same result may be observed if the albumen of an egg be submitted to the action of both poles.

" *Second.*—In the absence of this secretion, moisture only being present, a general stimulation takes place.

" *Third.*—Agitation.

" *Fourth.*—Lifting and loosening of epithelium.

" *Fifth.*—Attraction and disintegration.

" *Sixth.*—Coagulation of alkalies.

" *Seventh.*—The epithelium shrivels up.

" *Eighth.*—Detached and lost.

" *Ninth.*—Mucous lining dries, and gradually changes color from a pinkish red to white.

" *Tenth.*—At the commencement of the caustic action, absorption slowly takes place, tissue is absorbed and disappears.

" *Eleventh.*—The metallic extremity of the bougie insinuates itself in the deeper tissue, producing a depression; an aperture is made which forms a new passage.

" *Twelfth.*—The electrolytic action having made a passage, the albuminous secretions on the walls of the urethra are acted upon by the negative pole coagulating it, and bearing resemblance to boiling froth.

" *Thirteenth.*—By degrees a scab is formed.

" *b.* Electrolysis may become caustic in its action if too strong currents are used, destroying the tissue, leaving a denuded surface behind, which in the healing process throws out plastic lymph, fills up the cavity, and forms solid and adherent walls.

" *c.* If electrolysis of great power is used, it rapidly opens a passage. The perforation thus made forms a scab upon the walls of the urethra.

" My experience has proven conclusively that the means of

curing stricture consists mainly in using *weak currents*; and mischief may be done by strong currents, which destroy tissue rapidly, instead of causing chemical decomposition.

“ As seen by the foregoing, the two poles differ in their action, and therefore give different results. It further appears that the poles vary in their action with the material used. For example, by a general application with sponge electrodes, a certain result is obtained; the same current, similar in every way, will, by the use of a metallic electrode, become electrolytic. The faradic or induced current, as a general application, with the sponge electrode, is mainly used (and even preferred) to ascertain muscular contractility. Hence it is employed in paralysis, because it vitalizes, and stimulates the muscles into activity, sustains the action of the heart, impresses the circulation, and exerts a powerful influence over the motor nerves.

“ If the faradic current is employed with metal electrodes, or a sponge electrode as positive, and the bougie with metal bulb as the negative pole in the urethra, it prevents, or cures spasmodic action; hence, is a cure for spasmodic strictures.

“ It appears that the two poles are identical in their action, and manifest no significant difference, at least it is not so marked as in galvanization.

“ The galvanic, or constant current, as a general application, may be used with more or less advantage or benefit in all cases (although the faradic is preferred as a general tonic and stimulant), and acts as such principally on the sympathetic, motor, and sensory nerves, and its effects to equalize the circulation are very significant. But if galvanization is used with metal electrode to obtain electrolytic action, the result obtained will be widely different.

“ The positive pole will coagulate the blood, attract acid and oxygen: in fact, by a peculiar action the battery has yielded an acid product, which acts as actively and produces as painful and sloughing a sore as will the most powerful mineral acid, and leaves behind a hard and retractile cicatrix on the tissue with which it has been in contact; while the negative pole will dissolve blood, augments its fluidity, attracting hydrogen, coagulates albumen, attracts alkalies, and acts as a caustic alkali on the tissues, leaving behind a small, soft cicatrix, which is not retractile.

“ Now, the knowledge of the foregoing facts is of paramount importance, and they are all the more essential, inasmuch as they happen to be the great factors with which we should be acquainted for the intelligent application of the method under consideration.

“ *Method of Application.*—The first thing the operator will

have to consider is, the pathological condition of the particular stricture he has to deal with. Next, to devise a plan for his future action, select the method he intends to employ, and the treatment he means to follow; what he wishes and what he can accomplish in a single seance, and what he reasonably can effect. He must know WHEN to operate, and the time that should elapse before the operation is repeated. The patient should not be subjected to pain.

"Of course no stereotyped rule can be laid down which should be followed by all alike. Each case depends on its own inherent peculiarities, and must be treated accordingly. The successful issue of each case depends entirely on the operator's choice of method, and he should employ that one which offers the best chances of success, and which he deems the most effective.

"First.—Electrolytic action, by mild currents, from batteries united for tension, produces gradual chemical absorption, as before described. The current is gradually increased or decreased.

"Another method is a mixed operation. The passage is made by the action of a powerful electrolytic current, which may denude the surface of the urethra; the walls are kept apart to prevent adhesion. This indication is fulfilled by the introduction of the catheter immediately after the operation, and retaining it *in situ*.

"My predilections are in favor of the first method, and I use it because it is more desirable. If circumstances permit, I operate with it in preference to all others, because it is safe, and never has been followed by accident or ill effect. In fact it is the procedure here advocated, practiced and illustrated by cases. It is the method which treats the stricture through mild currents, by a '*galvanic chemical absorption*.'

"The mixed operation I only practiced when obliged to do so; that means, when the first method cannot be used with good effect, then the current must be increased. Only a very few aggravated cases will need this procedure. The after treatment must be conducted carefully, as the retention of the catheter in the urethra may cause irritation, cystitis and urethral fever. But even if it occasions, under very unfavorable circumstances, some inconvenience, it is preferable to the otherwise unavoidable perineal section, which, according to statistics, is dangerous. This method is particularly indicated, if the stricture is impassable and tough. The strong current may denude the walls of the urethra, and the plastic lymph thrown out will cause adhesions. To avoid such adhesions, the catheter is retained. The new entirely flexible rubber catheter is a great improvement for this purpose, as it is less irritating and self-retaining, thereby avoiding the dangers which might otherwise follow.

“Examination of the Stricture.—Stricture is a pathological condition of the urethra, which by alteration of tissue has narrowed its calibre.

“The object of surgical interference is the restoration of the urethra to its normal physiological and anatomical condition, which includes power, healthy action, and, above all, its form and natural calibre. This being accomplished, the cure is completed. The method which will accomplish this gratifying result with the least pain or inconvenience to the patient, with least interference with his daily avocations, is certainly the best.

“For all practical purposes, we may divide strictures in three classes:

“1. Spasmodic strictures; 2. Inflammatory strictures; 3. Organic strictures.

“Spasmodic strictures may occur as a consequence of irritation, venereal excesses, masturbation, excess of acid in the urine, pyelitis, diabetes mellitus, arthritis, cystitis, nervous debility, etc. I have already observed that spasmodic stricture is amenable to cure by the faradic current. This current is of much value if employed to confirm the diagnosis; but spasmodic contraction of the urethra, usually called stricture, is not *real* stricture, and has no bearing on, or relation to, the electrolytic treatment, and is here referred to merely as a comparison.

“The last two kinds of stricture are amenable to treatment by electrolysis. Both are generally the consequences of neglected acute urethritis, or the result of traumatic lesion. I have no intention to describe in this paper the different forms of strictures; I confine myself to the delineation of the last two. In the inflammatory stricture the calibre of the urethra is narrowed by the product of inflammation thrown out by exudation internal to the mucous lining. The case may be complicated by the presence of more or less granulations; whereas in organic stricture the calibre is lost by the pressure upon the altered parts, and heteroplasia of the deeper tissues. The knowledge of this pathological condition is a fact of much value for the intelligent and successful application of electrolysis. If this is understood, it necessarily follows that the organic stricture needs a stronger, and the inflammatory a milder current of galvanism in order to effect chemical absorption. Certain facts should be inquired into concerning the history of the case, such as the general condition of the patient, see whether inherited diathesis can be discovered, a peculiar dyscrasia, or if any complication be present at the seat, or anywhere adjacent to it. For example, if the stricture be complicated with cicatrices; if there be syphilis, or tertiary symptoms. If either of these complications be present, the case is not a favorable one for electrolysis. The patient,

under these circumstances, needs first constitutional treatment.

“ *Measurement.*—In order to ascertain with certainty the exact locality, length, size, etc., of the stricture, I generally introduce into the urethra a sound as large as the meatus will admit; by this manœuvre we ascertain at the beginning of our manipulation the normal calibre of the urethra. The sound is then gently pushed forward, until we reach the stricture; that being accomplished, we carefully note in inches, by actual measurement, the distance the first stricture is met with from the meatus. Next we ascertain how large a sound the stricture will allow to pass; at the same time an attempt is made to ascertain the length of the stricture. Having discovered the available sound, the exploration is continued until the whole of the stricture has been explored. If any more strictures are discovered during the investigation, they are measured in the same manner as the first; a note of their topography is made and carefully recorded, because in all future operations the perfect knowledge of the localities of the impediments is of extreme importance for their proper treatment.

“ After a careful and minute examination is made, and the state, size, etc., of the urethra duly noted, a plan of action and future treatment in accordance with the previous principles enunciated is decided on, and immediately carried out.

“ *The Modus Operandi.*—First.—The susceptibility of the patient to the galvanic current is to be ascertained, and is accomplished in the following manner: The two sponge electrodes are grasped in the palm of the hand; the metallic slide is carefully and slowly moved onwards, cell by cell; the strength of the current is thus entirely under the control of the operator, and should be augmented until the patient feels a pricking sensation. The toleration with which the patient endures the current without inconvenience indicates the tension suitable for the operation, and may be varied according to circumstances; still, it should always be in accordance with the well-known laws and influences which govern electricity.

“ The position which the patient should assume during the operation is a matter of slight importance; his own convenience should be consulted; he may either stand or sit, or may lie on his back with his knees drawn upward. In my practice the patient generally stands in front of me. Anæsthetics are not used, because I deem them unnecessary. On the contrary, I want the patient conscious, so that I may have the advantage of his statement as to the sensations experienced, during the progress of the operation, which, if rightly performed, occasions no pain.

“ One of the bougies with metal bulb, as already stated, is now

taken up ; the size to be selected will depend on the method determined upon.

“ If the stricture is not too firm or fibrous, I generally commence with a bougie which is three or four numbers larger than I judge the stricture to be, and on the well based supposition that the current will, through its peculiar action, absorb the stricture to such an extent, that the dilatation it produces will be equal to the difference of three or four sizes.

“ Having ascertained by actual measurement the locality of the stricture or strictures (if there be more than one), I push a small India-rubber ring over the bougie for each of them. This little manœuvre has many advantages ; not the least important is, that I am made aware as soon as the India-rubber ring arrives at the meatus, that the extremity of the bulb must be in contact with the stricture.

“ Having the plan of the urethra through actual measurement before me, I operate with additional certainty, and beyond a per-adventure, as to the part which is acted upon.

“ The operator of some experience in this kind of manipulation is always made perfectly aware by digital touch where the sound is, at any time during the operation. The bougie, well lubricated, is now connected to the cord electrode of the negative pole, and then introduced into the urethra down to the first stricture ; a sponge electrode is attached to the positive pole of the battery ; the current is completed by placing the sponge either over the superpubic region, the thigh, or inner aspect of the patient’s hand. I prefer the latter, because it is more pleasing to the patient, without weakening the effect of the negative pole. The current should now be very slowly and gradually increased, one cell at a time, or still more divided by resistances, until the patient feels there is a certain strength in the current. The galvanic current should never be so strong as to cause either pain or a burning sensation ; because, in that event, the current in its action would approach the galvano-caustic, instead of the electrolytic, which is not contemplated. Generally the power from eight cells is adequate, and will fulfill all the indications, and be found sufficient to overcome and penetrate the stricture. It will be found that an application of three to five minutes will be enough to make an impression ; less time may answer for the bougie to advance and slip through the impediment.

“ During the whole of the operation, the bougie must be held loosely and gently in its place against the obstruction ; all pressure or force, however slight, must be avoided. The bougie will take care of itself, doing its own work by the electrolytic power its action involves ; whereas, pressure would not only defeat the object and purpose of its application, but expose the patient to

serious danger from hemorrhage, or even rupture of the urethra.

" The operation being completed, care should be taken to reduce the battery to 0, by gradually moving the slide back to the starting point, cell by cell, and only one at a time. When the slide is returned to the point from which it started, the current should be interrupted.

" It will be observed that on withdrawing the bougie electrode, there is found surrounding its metal bulb a frothy, yellowish mass, which bears a strong resemblance to coagulated albumen. This product is part of the stricture, which has been decomposed by the electrolytic action of the battery. There are failures on record, but in my opinion this want of success is mainly due to a too prolonged or to a too frequent application of the current, and to the causes previously enunciated. The applications, to warrant a successful issue in any given case, should be repeated at intervals of at least two weeks, and in some instances a longer period should elapse before I would repeat the operation. However, if all things are favorable, and circumstances give me absolute control of the case, I would prefer a period of four weeks to intervene between the operations. This treatment must be continued until the urethra has recovered, and resumed its normal calibre, whatever this may be. As a rule, every patient may be well satisfied if his urethra admits a No. 12 English sound, and has no reason to complain that a stricture is troubling him. But if a large man has a normal urethra, the calibre of which corresponds to a sound No. 15 or more, our treatment with electrolysis must be continued until the size of such urethra is sufficiently restored to correspond with the normal calibre. At times I have found a normal urethra of the size of No. 11, the meatus even a little smaller, admitting the No. 11 sound only after careful stretching; and it was clearly proven that such urethra never had been larger. In all such cases I am well satisfied with a restoration to size No. 11, and would not think of enlarging such a urethra any further.

" The question may be raised here, whether our treatment is ever followed by urethral fever, cystitis, or any other complication. To this I answer, that during the three years in which I practiced the *first* method, I never had any untoward symptom. But any complication may arise if either the patient or the operator give cause. Urethral fever is caused by a rough handling of instruments, or an over-exertion of the patient after the operation. Avoid the causes, and you will have no consequences. For this reason only I recommend the first method; but the mixed operation must be employed in certain cases, in order to avoid more dangerous means, which is the more justifiable, since Dr. Bumstead, in his excellent work, admits that ' either of the

modes of treatment (of stricture) now described, may be followed by rigors and other unpleasant symptoms, which are known as urethral fever.' To illustrate this, I will now narrate an interesting case, in which circumstances forced me to practice the mixed method in order to avoid the more dangerous perineal section."

"*CASE 2131.—Traumatic Impassable Stricture of Nine Years' Standing Treated Successfully by the Mixed Method of Electrolysis.*—Mr. S. M. S., of Hartford, was sent to me by Dr. Storrs, of Hartford, on July 22, 1872, with the following history of a traumatic stricture: Mr. S. was in the mounted service during the war. In 1863 contracted an abscess in the perineum, which resulted in a urethral fistula. In 1864, Dr. Blackman, in Cincinnati, closed the fistula. The operation was a cutting one, and the wound was left open to heal by granulations. Soon a stricture of the urethra followed, which was treated by the introduction of sounds at intervals. The stricture grew gradually worse, until no instrument would pass it. For the last six weeks the urine only dribbles away by drops, and not the smallest sound or even catgut will pass the stricture. The kidneys are disturbed, occasionally congested. The urine is pretty constantly albuminous, which is occasioned by the difficulty of passing water. For years he never had entirely emptied his bladder, as a residue was left, causing cystitis. The ureters were often filled with urine, producing disturbance of the kidneys. On examination, I found that a large steel sound No. 12 entered the meatus easily, and passed down to the seat of the stricture, which was six inches from the seat of the meatus. Whalebone bougies, catgut and other instruments of the smallest size were tried, but none passed the stricture. Next an examination was made with the endoscope. The large tube enters, with a little difficulty, a distance of six inches, where it encounters the stricture. On inspection, we see that the stricture is well formed, and a plastic exudation, like a duck's web-foot, presents a grayish white appearance, with elevations standing out like granulations. On the right side the remnant of the opening can be seen, very narrow, irregular, congested, irritated, and bleeding on slight touch. Next electrolysis was used with Drescher's galvanic battery. A bougie No. 6, the end of which had a metal bulb, was introduced to the seat of the stricture, and attached to the battery as the negative pole; the circuit was completed by the sponge electrode in the hand of the patient. The current was kept up for eight minutes, but the bougie would not enter the stricture. Then a bougie No. 3 was substituted, and passed into the stricture slowly, and worked its way until it was seven inches in the urethra. Here it could be felt distinctly that

the bougie was at the end of the stricture, and it was then pushed easily into the bladder to its whole length—nine inches. Hence the stricture was one inch long, from six to seven inches deep. After this operation he felt somewhat relieved.

“ Aug. 12.—Battery of twelve cells for twenty minutes, with metal bougie No. 6, entered the stricture three-eighths of an inch, but would go no further, nor pass the whole stricture. Hemorrhage prevented further operation.

“ Aug. 13. Has had a good night’s rest. Urine passes with difficulty, and burns a little. No instrument will pass the stricture. Chloroform was given, and electrolysis used. A steel sound No. 7 as negative pole was introduced, and full twenty cells used for twenty minutes. At last the sound passed the stricture and into the bladder. Chloroform was then discontinued, and a bougie No. 15, with a metal end, and the other part insulated, introduced as the negative pole. The patient was conscious, and saw how the bougie No. 15 passed through the stricture into the bladder. The bougie was slowly withdrawn under a galvanic current of fourteen cells. The patient felt no bad effects afterwards, no pain. One hour afterwards he passed water. He left for home in a few hours.

“ Sept. 9.—After last operation he has improved, and passed a steady stream of water, equal to about No. 3 or 4. But within the last few days he has grown worse, and the urine only dribbles away with difficulty and pain. Endoscope (large tube) shows an immense inflammation and irritation at the stricture, and many small granulations have sprung up; therefore it is thought not advisable to interfere operatively at this time, as no good result possibly could be expected under the circumstances. In order to allay irritation and gain space, urethral suppositories were ordered.

“ Sept. 15.—Feels better; says in five years he has not felt so well. He passes water better, and is free from any irritation or pain.

“ Sept. 17.—His constant hard labor in business, and the travels on the railroad, have excited the parts to such a degree that he has a relapse, and cannot void urine, which only dribbles away in drops. No instrument will pass the stricture, not the smallest. My friend, Dr. W. H. Maxwell, of this city, saw him in consultation, and coincides that an operation for his relief is unavoidable, but is not advisable here in a hotel, where our patient is without care, away from his friends. Consequently he went home, and on September 25th the operation was performed in Hartford, in the presence and with the kind assistance of Drs. Storrs, Fuller, Elsworth and Russel, all eminent practitioners of Hartford. Under chloroform another effort was

made to overcome the stricture, which was still impassable to all instruments. Then the electrolysis was used, but my usual bougies were not stiff enough, and becoming too flexible, might have made a false passage. Now the only alternative was a different form of electrolysis, with strong currents, to overcome the stricture, or perineal section. But as this latter plan could be pursued if the other failed, therefore electrolysis was decided upon. A steel sound No. 7 was introduced to the seat of the stricture, and the free end connected with the negative pole of the galvanic battery. The circuit was completed by a sponge electrode as a positive pole, and held firmly on his thigh. The electrolysis was kept up with twenty cells for nearly half an hour, during which time the sound made slow but steady progress. The advance was directed with one finger in the rectum, and only guided by the anatomical relation. At last the sound could be moved within the bladder. In consultation, the plan of the after treatment was decided upon, of which the important point was to keep the urethra open, and thereby to prevent adhesion. The patient was then left under the care of Dr. Storrs, to whose judicious treatment I am indebted for the final result. Dr. Storrs' notes are as follows:

“ Wednesday night restless; first micturition only blood; second time, before daylight, a full stream. Ordered morphine, gr. ss.; dose every two hours.

“ Sept. 26.—Morphine only two doses; pulse 120; sensibility of skin and thirst; urine in full stream.

“ Oct. 1.—Urine with more difficulty; smaller stream and straining; pulse 80; catheter No. 3 passed, then a No. 5 was left for the night; suffering pain, and frequent vomiting.

“ Oct. 2.—Catheter removed; patient fell asleep; when attempting to urinate, the flow ceased suddenly; after pain and straining, a calculus was voided; then the urine flowed in a large stream, and in an easy way, such as had not been known for years.

“ Oct. 5.—Catheter No. 5, easy.

“ Oct. 21.—Catheter No. 11, easy; considered well.

“ Dec. 12.—Sound No. 12 introduced by himself.

“ I firmly believe that the calculus voided by the urethra was encysted in the bladder near the sphincter, and that the electrolytic action loosened it from its encasement. The sudden stoppage of water on Oct. 2 was caused by the calculus dropping into the urethra. The patient has been kept under observation, and has remained well. Only to confirm the success, he passes, in long intervals of many months, a sound No. 12 into his bladder, and reports well.

“ The first method, as described before, I practice now almost

exclusively, and consider it the only safe one. I have about thirty cases on record, of which the following, in brief, I will mention, as details would cause too much repetition:

“CASE 2045.—*Two Strictures, Complication of Syphilis.*—W. H. B., an actor of this city, came under my treatment in March, 1871. Found on examination two strictures at one and at five and a half inches. Had syphilis, which aggravated the strictures, and undoubtedly this complication caused the strictures to impart a feeling of cartilage, which brings them almost under the calcareous species. The patient received constitutional treatment, and a few seances of electrolysis cured the strictures. He has been heard from recently, and has remained well.

“CASE 2092.—*Two Strictures. Chancroid. Failure of Dilatation. Successes with Electrolysis.*—R. A., a hotel keeper, came under my treatment in March, 1872. Had been treated in the country for stricture by dilatation, with no success. Found a chancroid in the urethra, which was treated first. The two strictures were found situated at one and a quarter and four and a half inches from meatus, respectively.

“Mar. 22. Electrolysis was used with a bougie No. 10, with a metal bulb as negative; positive electrode in the palm of the hand. Ten cells of the galvanic battery were used for nine minutes, and the bougie passed slowly through the strictures into the bladder.

“April 14. The operation was repeated with a bougie No. 12. The patient has been heard from only recently, and has not had a relapse.

“CASE 2098.—*One Stricture, Spermatorrhœa, Impotence, Melancholia.*—March, 1872: R. T., merchant, in Philadelphia, came to my office in an advanced stage of hypochondriasis, complaining of general malaise, spermatorrhœa, impotence, small stream of water, pain in the urethra, etc. A steel sound No. 12 entered the urethra easily, but was arrested at seven inches. Sounds of smaller size were all arrested likewise at the same point. There is no doubt that a stricture exists, and at last a sound No. 7 passed it with difficulty. The trouble must exist either at the junction of the membranous and prostatic portions, or in the latter. Galvanism was used with ten cells. Bougie No. 10, with metallic end as negative into the urethra; met the same obstruction at seven inches. The positive pole was a nickel bulb, and grasped firmly with the closed hand. After five minutes of the electrolytic current, the bougie passed the stricture slowly, and slipped into the bladder. The withdrawal of the bougie was followed by a thick gleety discharge. It seemed that this matter had accumulated behind the stricture, irritates

the prostatic portion and the ducts, and thereby was accessory to creating a spermatorrhœa. On passing water, shreds came along of a thick, white mass, which were the product of electrolysis. The operation had not caused pain, and the patient travelled home without any unpleasant feeling.

"April 16. On examination with a sound No. 10, found the stricture at the exact place. The sound passed the stricture after persistent and patient efforts.

"Then the galvanism was used as before, with a bougie No. 12 as negative, and with the same result.

"May 9. In Philadelphia, a sound No. 12 could be easily passed into the bladder, which proves that the stricture is cured. The patient has been kept under observation for two years, and was seen only two weeks ago; he is perfectly well; has been married since, and is the father of a healthy child.—[Impotence cured.—PITZER.]

CASE 2129.—*Gonorrhœa and Stricture.*—July, 1872: M. M., merchant, has a gonorrhœa for four months, which has been aggravated by strong injections, which was followed by phymosis and epididymitis. On examination, found a large urethra; at one and a half inches a stricture which permits the passage of a No. 9 sound; at five inches a soreness is encountered, which was afterwards diagnosticated by means of the endoscope, as granular urethritis. After proper treatment of the complications, the stricture was cured by electrolysis in three seances, as follows:

"July 30. Galvanic battery ten cells. The bougie No. 12 absorbed the stricture in five minutes.

"Aug. 17. Bougie No. 13 passed the stricture in five minutes, during which the galvanic current was gradually increased to fourteen cells.

"Sept. 14. Galvanism with nine cells for eight minutes. Bougie No. 15 passed through the whole urethra slowly.

"Patient was ordered to introduce sometimes a No. 15, with an ointment, in order to overcome and heal the soreness of the urethra.

"He has been seen since frequently, and during the twenty months following the electrolytic treatment no relapse has occurred.

"This is a typical case, in which circumstances permitted the treatment to be carried out as recommended in a former part of this paper. The urethra of this patient has retained the calibre of No. 15.

"CASE 2155—*One Stricture and Gleet.*—Nov., 1872: Mr. P. had gonorrhœa fifteen years ago; cystitis with haematuria one year ago, and since a serous discharge, with diminished stream of water.

" Found one stricture one inch from meatus, which was cured with electrolysis in two sittings. Patient has left the city, and has not been heard from since.

" *CASE 2162.—Gonorrhœal Stricture.*—Dec., 1872: W. R. B., clerk, had gonorrhœa last spring. The discharge ran for five months. Last week had connection, and found on the following day a discharge; it has now run slightly for one week; stream of water is small; straining troublesome; *bougie à boule* enters into a pouch at two and a half inches; sound No. 11 encounters a stricture at five and a half inches; therefore, it seems that the discharge emerges behind the stricture and is caused by it. Conclusion is, the cure of the stricture will remove the discharge. Two galvanic applications were made at intervals of four weeks, after which a bougie No. 13 passed the whole urethra easily. The patient was dismissed as cured on Jan. 21, 1873. He has remained under observation and is perfectly well.

" *CASE 2164.—Simple Stricture.*—Dec. 30, 1872: H. B. S., from Connecticut; defective history; has one stricture at two and a half inches, which was restored to a normal state in one seance; on a subsequent visit was found well.

" *CASE 2165.—Three Strictures.*—Dec. 30, 1872: S. J., saloonkeeper, was brought to my office by Dr. Good.

" The patient has had strictures for a long time, which resist all dilatation; are tough, and cause painful micturition, with a small stream.

" Whalebone *bougie à boule* finds three distinct strictures at two, four, and five and a half inches, of a parchment feel.

" Galvanism was applied; the sponge electrode as positive pole was pressed in the iliac region, and a bougie with metallic bulb pushed into the urethra as the negative pole. In six minutes, with the current of fourteen cells, all strictures were overcome. Immediately after the operation, he passed water without pain or difficulty. The stream was full, and larger than he has had for many years. The patient has not been heard from since.

" *CASE 2179.—Stricture of Three Years' Standing.*—Jan., 1873: T. G., from Missouri, has a bad stricture at five and a half inches, of three years' standing, caused by a prolonged gonorrhœa.

" The treatment was tedious, and was retarded by the patient's imprudence. At last the galvanism absorbed the stricture, so that a sound No. 15 could be introduced easily into the urethra. The patient went home after three months' treatment, and has since reported well.

CASE 2192.—Three Strictures.—April 16, 1873: G. S. B.,

from Oneida Co., was sent to me by Dr. Good. *Bougie à boule* discovered three distinct strictures at two and three-quarter inches, at three and three-quarter inches, and at six and a half inches respectively. In withdrawing the small bougie No. 4, it remained engaged in the second stricture, and was decidedly fibrous. Strong fibrous bands held the extremity of the bougie firmly, and to disengage it, it was almost necessary to rupture that stricture to a certain extent.

"The electrolytic action was applied as in the other cases, and the bougie No. 8 connected with the negative pole passed slowly through all the strictures in five minutes. The patient reappeared two days afterwards, and reports marked improvement. He says he must return home, and therefore wishes another galvanic application. It is against all rules to repeat such an operation after so brief an interval; but necessity knows no rules. The patient had to go home, and felt so much better after the first operation that he desired a repetition, and promised to return as soon as necessary. Therefore an exception from the rule was made, and the galvanism applied again with an excellent result. The bougie No. 11 passed slowly through all the strictures in four and a half minutes. The patient passed a full stream of water, and felt marked relief. Before his departure home on the next day, he came again to state that he is well, feeling no soreness or fatigue. I heard from him in the fall, and he reported well.

"CASE 2204.—*Stricture and Gleet.*—June, 1873: J. R., saloon-keeper, is near his wedding; has a gonorrhœa, which, under the treatment of a druggist, grew worse; has also an abscess in the glans, near the frenum; has fever and pain in consequence of the inflamed urethra. After subduing the inflammation by internal means, the discharge continues. On examination with a *bougie à boule*, a stricture was found at four inches. There was a contraction, a hard, fibrous resistance. Galvanism applied; positive in hand, bougie No. 11 in urethra as negative, soon passed the stricture. Then an injection of water brought by its return a large semi-solid white mass, looking like dead skin thrown off. This was the product of the galvanic action, the real stricture absorbed. It had an alkaline reaction, fibrous in appearance, and looked like the core of a carbuncle. There is no doubt that a former gonorrhœa had caused the stricture, behind which a pouch had formed, which acted as a receptacle, and created a discharge, by which means the stricture grew worse. Now it is natural that no remedies adapted to gonorrhœa or gleet could have stopped the discharge; but the treatment of the stricture cured the gonorrhœa. The patient felt no pain from the operation, and was easier immediately. Two

days afterwards a sound No. 12 passed into the bladder, and no discharge followed. He married, received afterwards a little treatment, and all went on well. He has been under constant observation, and has remained in good health.

“CASE 2229.—*Three Strictures.*—Sept., 1873: Mr. E. S., New Haven, about twenty years since had a gonorrhœa; was treated only with medicines; had no injections and finally recovered. Twelve years ago had renal difficulties; passed acid formations from the kidneys, but never passed calculi. Two years ago the stream of water grew smaller by degrees, and sometimes he could not void urine at all. Was treated for stricture, but was not relieved. On examination, the *bougie à boule* encounters three strictures:

“First, at three and one-eighth inches, which is overcome by rotating, and directing the points to the anterior wall of the urethra. The bougie is not caught on the return, but slips easily back.

“Second, at five and a half inches, from which point the calibre of the urethra remains narrowed until the

“Third stricture, at six and a quarter inches, which is only overcome by bending into the curve, and slowly pushing and pressing forward. This last is the worst stricture.

“Oct. 3.—Galvanic battery used. A No. 13 bougie, with metal bulb as negative pole, passed through all the strictures in four minutes. The bougie, during the action of electrolysis, was firmly grasped by the strictures, and even by the prostate, and advanced slowly and by degrees into the bladder, so that the full measure of the bougie introduced was ten inches. The battery used was very weak, and therefore twenty cells were in operation. The positive sponge electrode was held in the palm of the hand. The electrolysis was kept up seven minutes in all.

“Oct. 21.—Galvanic application repeated as before; nine cells for ten minutes. The bougie No. 15 as negative had scarcely any difficulty, and entered soon through all the strictures.

“Oct. 31.—Slight galvanization. Bougie No. 15 entered easily, without detention or pain. The patient passes a large stream of water now. For other ailments he is still under treatment, but the urethra has had no relapse.

Other cases have been treated recently, and the record would not be so valuable, but I believe the clinical facts here recorded are sufficient basis for the theory elicited in the first part of this paper. And in conclusion, I can only repeat that I only recommend the first method as a perfectly safe one; and the success of the electrolysis depends mainly on the chemical decomposition or absorption by mild currents, very gradually increased, and repeated at sufficiently long intervals.

“New York, Feb., 1874. ROBERT NEWMAN, M. D.”

" Since my last report was written, August, 1882, almost daily new cases have been presented, and treated with the same uniform success as related in the former paper. Scarcely any simple cases came, and most of them were the worst and most aggravated strictures which can come under observation, and many patients were accompanied by their family physicians, who acknowledged that they could not pass such strictures with any instrument, no matter how small. In all case the strictures were passed by the electric bougie. This means that the absorbent power of the electrolysis enabled that size of the instrument to pass, which could not have been done without the aid of the electrolysis. To illustrate this power and the method, some selected cases will be related here:

" *CASE 1.—Six Strictures of Twenty-five Years' Standing, Impassable by Instruments, Cured by Electrolysis.*

" October, 1882, Dr. D., æt. 57 years, a regular physician, practicing in Long Island, suffered with stricture of the urethra for over twenty-five years, and has been treated off and on, in the usual manner, with only temporary relief. He noticed the stricture first in 1857, which gradually became worse. Since 1877 he has been under the care of one of the most eminent surgeons, lately deceased, who during these years never could pass an instrument through all the strictures into the bladder.

" 1882, October 17th.—Patient came under my treatment, complaining of having scarcely a stream of water at all, not being able to use a force sufficient to propel the water. The stream is very small, almost diminished to a dribble. Penis is cold and flabby. Meatus is large, admitting a sound No. 26, French. A small whalebone *bougie à boule* detects the whole urethra in an indurated state, scarcely free from strictures anywhere. The whole canal is a mass of strictures, with little intermissions, and the small bulb is arrested everywhere. The bougie passed with difficulty three distinct strictures, and was firmly grasped and arrested at the fourth, at five inches from the meatus. No instrument would pass this fourth stricture.

" *I. Electrolysis.*—The patient was kept standing, resting himself with one hand on the back of a chair, the other hand holding the electrode from the positive pole of the battery, and pressing the wet sponge cover against the thigh. A stiff electrode bougie, insulated, except the metal end, egg shaped, No. 11, French, is introduced into the urethra, the other end of the bougie is connected with the wire, which in turn is connected with and used as the negative pole of the battery, and completes the circuit. As soon as the bougie is arrested by the first stricture, the current of the electricity is slowly increased cell by cell, till the susceptibility of the patient tells that the current is

strong enough, without causing pain. During this seance ten cells were used for twenty minutes. There was slow progress, but the electricity worked its way through all the strictures, and at last entered the bladder. The current was kept up while the bougie was being withdrawn, and was held loosely in each stricture till it could be moved easily, and it was distinctly felt that the contraction was absorbed. The bougie was neither pushed nor pulled, only guided by two fingers of the hand. The work was thereby done entirely by the galvanism, without causing any pain nor a particle of hemorrhage. The patient was much pleased with the result, and passed water immediately in a good full stream. From this operation the seat of the strictures was ascertained to be as follows:

“First stricture, at $1\frac{3}{4}$ inches from the meatus; second, at $2\frac{1}{4}$; third, at $4\frac{1}{2}$; fourth, at 5; fifth, at $5\frac{3}{4}$; sixth, at 7.

“November 8th.—Since the last operation, about three weeks ago, patient has attended to his practice, and has felt better than for many years.

“II. *Electrolysis* was used in the same manner as before, with an electrode bougie, No. 14, French, which passed through all the strictures in ten minutes, while a current of ten cells was working.

“November 18th. III. *Electrolysis* with a conical sound No. 17, as the negative pole, which after passing was replaced by a No. 17, French egg-shaped bulb. In withdrawing, the latter worked up and absorbed each stricture in turn, so that the instrument could be moved about freely without any restriction; ten cells were used for thirteen minutes. To use two electrodes in succession during one seance is against the rules, but was indicated in this case as an exception.

“December 22nd, 1882. IV. *Electrolysis*.—Bougie No. 20, French, with ten cells for ten minutes. Strictures were tight, but offer less resistance, and bougie soon passed through all of them. There is much improvement.

“1883, January 5th. — *Electrolysis*.—Bougie No. 21 passed easily; nine cells for twelve minutes.

“January 19th. VI. *Electrolysis*.—Bougie No. 23 for twelve minutes, with a current of eight cells, passed, but had to work each stricture separately.

“February 13th. VII. *Electrolysis*.—Bougie No. 26, French, with seven cells for eleven minutes, passed more easily than ever before. In four minutes had worked through all strictures, and passed into the bladder. Not the slightest pain was occasioned. The patient is in excellent health, has regained a natural stream of water with good force, and says he feels better now than he ever did during the last twenty-five years. Is well in every respect.

“CASE II.—Four Strictures Fifteen Years Old, with Incontinence of Urine.

“October 17th, 1882.—Mr. B., from Jersey, was brought to my office by Dr. Field. The patient has suffered for fifteen years without being cured by the usual methods. He is now run down, very weak, has lost flesh, is never free from pain, is constantly straining, and can neither pass water nor retain it. The urine dribbles away constantly from overflow, and thereby excoriates the tender skin, notwithstanding that the patient wears a urinal. The patient passes sleepless nights, and is in constant agony. At present no instrument will pass. On examination, I found that no instrument would pass the strictures. The exploring *bougie à boule* encountered a mass of hard strictures, which were passed only by manipulation, and with difficulty, and was soon arrested. Then a small filiform guide entered everywhere into lacunæ, which bled on ever so careful an examination, and at five inches from the meatus no instrument would pass any further. The family physician present said he knew that no instrument would pass any further than five inches. If he had been able to pass it, he would not have brought the patient to me. Electrolysis was then tried. The patient was placed on the operating table in a half recumbent position. The positive sponge electrode was held on the abdomen; the negative pole, in the form of a No. 14 French bougie, was inserted into the urethra. The electric current was gradually increased to eleven cells, and during seven minutes the bougie made steady progress, advancing slowly, and working its way into the bladder, to the great relief of everybody present. There were four distinct strictures, at three and a half, five, six and a half, and eight inches respectively from the meatus.

“October 27th.—Filiform bougie was tried in vain, it hung in lacunæ everywhere, and fearing to cause too much irritation it was abandoned. A whalebone bougie No. 8 passed easily into the bladder.

“Electrolysis was used, with a bougie No. 14, French, which, with a power of seven cells, worked slowly through all the strictures. The third stricture was very tight. Present, Drs. Field, Payne and Brush.

“The electrolytic applications were continued at intervals of ten days. In four seances up to November 28th, the patient has so much improved that he has gained fifteen pounds of flesh, which gives him normal weight; the water passes freely; the bladder is entirely under control, and the urinal discarded. He is well, attends to his business, and enjoys life.

“CASE III.—Four Strictures of Twenty Years’ Standing Cured by Four Seances of Electrolysis.

“November 14th, 1882.—Telor T., æt. 62 years, residing in

New York City, came to me with a complete occlusion of the urethra, and consequent retention of urine. Has suffered twenty years with strictures, a consequence of urethritis. No treatment has cured him. The strictures became worse, so that recently he is in constant pain, having had retention and incontinence at the same time, the water constantly dribbling away, and incapacitating him for any work. The smallest instrument would not pass the stricture, but an electrode bougie, No. 14, French, worked its way slowly, with the power of twelve cells for seventeen minutes, through all the strictures and into the bladder. Present, Drs. Meier and Basset.

"December 20th.—After three electrolytic applications, the patient says that his stream is large, and he is better in every way than for the last twenty years. Soon after a bougie No. 23, French, passed easily.

CASE IV.—Stricture of Ten Years—Rupture (Partial) of Urethra.

1883, February 20th.—Dr. Munson, of Bridgeport, had the kindness to bring this interesting case to my office, with the following history: Mr. A., at 36 years, suffered from a stricture of over ten years standing, a consequence of urethritis, which off and on closes up. He is an inventor, and made himself an instrument for the dilatation of the stricture, consisting of a steel rod, surrounded by a spiral spring, which by turning was inserted into the stricture like a corkscrew. He felt the stricture closing up entirely, and used his instrument as he had done before. In giving another twist, he ruptured the urethra, which caused severe pain and hemorrhage. Micturition could only be performed imperfectly, merely by an overflow of the bladder, causing a dribbling away. The patient was brought to my office by his family physician, Dr. Munson. From the history of the case it was evident that the treatment most indicated for relief would be perineal section, but as the patient needed immediate relief, I tried the introduction of instruments into the urethra. Whalebone *bougies à boule* and guides of different sizes would not enter further than five inches, the seat of the stricture and rupture. Each guide entered and stuck in some of the pouches, but none entered or passed the stricture. Therefore the filiforms were abandoned for fear of creating more irritation and hemorrhage, and direct electrolysis tried. An electric bougie No. 12, French, as negative pole, was carefully introduced and manipulated in the urethra, while the positive sponge electrode, held above the pubes, closed the circuit of a galvanic battery of which seven cells were used. The bulb of the electrode glided by manipulation over the partial rupture of the urethra and engaged itself in the stricture, where it advanced slowly, absorbing

and finally passing. The patient was nervous, but held still, felt each movement as the bougie advanced, without any pain, nor was a drop or a show of blood drawn. Immediately after this operation, the patient passed a steady, good stream of water, such as he had not seen for years.

“The electrolysis was used for ten minutes. Rectal suppositories of belladonna were ordered.

“*March 6th.*—Since the operation the patient has felt comfortable, and the stream of water has increased in size. Electrolysis, with a bougie No. 14, French, was worked for twenty minutes with eleven cells, and passed the stricture slowly, absorbing considerably the indurated masses. On April 10th, Dr. Munson reported the patient much improved, and doing well.

“Aggravated cases, like the foregoing, and others with different complications, I see often, almost daily, so that I could tabulate hundreds of them. The operation never causes pain, nor detention from ordinary business, which often surprises the patient. A physician residing in Connecticut wrote me on his return home: “I was much surprised to find that there was less irritation after the use of electricity than after the introduction of the simple sound. The annoyance caused by the electricity was simply zero.”

“Since my article was written last summer, I have received many reports from eminent practitioners that they have either adopted my method, or have practiced it independently with equal success. Among others, Dr. D. A. Farrand, of Detroit, Mich., writes, Oct. 6th, 1882, that after reading my article, he has operated with electrolysis on about eighteen strictures with very gratifying results. Great pleasure was given me in a letter from Dr. Hutchinson, of Providence, dated September 28th, 1882, in which he says he has operated in 21 cases in the last six months with unvarying success.

“By the unique good results, the method of electrolysis in the treatment of strictures is fully tried and established; every day brings new converts and new friends.

“I will conclude this article with some rules, as a safe guide to practitioners who wish to adopt the treatment of electrolysis in stricture of the urethra, which will also serve as answers to numerous questions received from correspondents.

“For the positive pole of the battery a carbon electrode is used, covered with sponge, moistened with warm water, and held firmly against the cutaneous surface of the patient’s hand, thigh or abdomen.

“For the absorption of the stricture the negative pole is always used.

“Electrode bougies are firm sounds insulated, with a hard-

baked mass of rubber; the point is a metal bulb, egg-shaped, which is the acting part in contact with the stricture. These electrode bougies are made by Geo. Tieman & Co., as also by H. H. Stammers, and other instrument makers.*

"The curve of the bougie is short; large curves are mistakes.

"The plates must be immersed in the battery fluid before the electrodes are placed on the patient, and raised again after the electrodes have been removed.

"All operations must begin and end while the battery is at zero, increasing and decreasing the power of the current slowly and gradually; avoiding any shock to the patient, or any interruption of the current.

"Before operating, the susceptibility of the patient to the electric current should be ascertained.

"The problem is to absorb the stricture, not to cauterize.

"At first it is best to operate only by the first method of absorption, '*weak currents at long intervals.*'

"The exact number of cells to be used can not be given, it must be regulated according to the work to be done. As a general rule six to twelve cells may be used.

"The seances should be held at intervals, not too frequent in succession.

"The best position for the patient to assume during the operation is that which is most comfortable for him and the operator.

"I prefer the erect posture, but the recumbent, or others, may be used.

"Anaesthetics I like to avoid; I want the patient conscious, so that he can tell how he feels.

"Force should never be used; the bougie must be guided in the most gentle way; the electricity alone must be allowed to do the work.

"During one seance two electrodes in succession should never be used.

"All strictures are amenable to the treatment by electrolysis.

"Pain should never be inflicted by the use of electrolysis; therefore it should not be applied when the urethra is in an acute or even subacute inflammatory condition. In order to have success with strictures it is necessary to be a skilful surgeon, who understands the anatomy, and is master in handling the instruments. For our purpose the operator must also be an expert in electricity besides a surgeon. Some of our young men consider themselves surgeons after buying a new set of instruments in a rosewood case. If they do an operation bunglingly they condemn a good method. And some old men

*Aloe & Hernstein, of St. Louis, keep them.

never wish to adopt any innovation, because they have not learned it at college. But old men must die off, and progress can not be hemmed in.

“New York, May, 1883.

ROBERT NEWMAN, M. D.”

We regard this method of treating stricture of the urethra of great value, and since the appearance of the first edition of our work on electricity we have verified the truth of Dr. Newman's methods, and regard his papers as a valuable addition to electro-therapeutics, or electro-surgery, as we may please to call it.

G. W. Overall, M. D., in a clinical report to the *Mississippi Valley Medical Monthly*, gives us a very good example of this treatment. It is Prof. Newman's method, and reads as follows:

“GENTLEMEN:—I have before you C. L., white, aged forty-four, Canadian by birth, tailor by occupation. His history is briefly as follows: In 1863 he had gonorrhœa; in 1870 the first symptoms of stricture were manifested; in '74 he was operated upon by gradual dilatation, which treatment lasted six months. He then began to have incontinence of urine and suffer considerable pain on micturition. In about five months thereafter he again found that he could not pass his urine without considerable difficulty. This condition continued until 1878, when he was operated on by urethrotomy and dilatation. The caliber was kept patulous for about two years, when it again closed, and he has been suffering with his urine percolating, drop at a time, ever since. When admitted to the hospital a few days ago, he was having paroxysms of intermittent fever, in addition to his stricture.

“I find, on examination, that the meatus is very much contracted, and as the stricture will not admit a No. 1 sound (Am. scale), I will take a very small olive, equal in size to about a No. 6 sound; I will screw this on to the end of my stiff urethral electrode, which is insulated with vulcanized rubber. I much prefer this to the flexible. I use the constant or galvanic current, attaching the urethral electrode to the cathode, while I attach the sponge electrode to the anode, which the patient holds in his hand.

“I now pass the electrode into the urethra, before the current is made, and continue it down till it comes in contact with the stricture. I make the current with four cells in the circuit. He does not feel this in the urethra, so I will increase the number, one cell at a time, until I now have nine cells, and he feels a slight pricking sensation. It is important to note the time the current passes. I increase the number of cells to twelve. He

still suffers no pain. I keep the electrode pressed firmly, but not using any force, against the stricture. The current has been passing eight minutes, and I can feel the electrode entering the stricture. It is now seventeen minutes since the operation was begun, and it has passed into the stricture about an inch, but not entirely through. Although he has no pain, the current has passed as long as is practicable, so I withdraw it, having previously broken the circuit. I do not pass it longer, as it might be followed by hemorrhage and slight inflammation. I introduce a No. 11 sound. It passes as far as the electrode did, but no further. We will now allow him to pass his urine, and see if he can pass it any better. It only passes in drops, as before the operation, but he says it drops faster than it did previously. He has no hemorrhage nor pain. The operation is not complete, so I will have to finish it in about six or seven days.

"April 19th. Dr. Watson (the resident hospital physician), as well as the patient himself, tells me that on the morning of the 13th, the day after the operation, he passed a very good stream, and has continued to do so since.* I now introduce a No. 12 sound, and find that it does not pass further than the electrode did at the previous operation. I pass the urethral electrode with an olive on the end, equal to a No. 11 sound, and make the current with six cells, then increase to nine, when he begins to feel the pricking sensation. The electrode passes into the bladder; I break the current, withdraw the instrument, introduce a No. 12 sound, and find that it passes into the bladder without meeting with any resistance. I will allow Dr. Watson to enlarge the meatus, when a much larger sound can be introduced.

"One peculiarity of this operation is that the caliber of the urethra, where the stricture was before the operation, is generally larger than any other portion of the canal. The patient has been working in the hospital ever since the operation, and says he can pass as large a stream as he ever could, and without any trouble. I now consider him entirely cured. You very naturally ask, how does the current act towards effecting a cure? I have shown you, in my experiments at a previous lecture, the electrolytic effects of the galvanic current in passing through different salts in solution. I took, as you remember, the chlorides of pot. and sod., etc., and by passing the current through them they were decomposed into their chemical elements — the electro-negative elements, as chlorine, oxygen, the acids, etc.,

* The resident physician informs me that on the 15th ult. my patient had a chill, but as this was three days after the operation, and as he had been having them before, it could not have had any connection with the operation.

going to the anode, and the electro-positive elements, such as nitrogen, hydrogen, and the alkalies, passing to the cathode. Then I took the white of an egg, which contains the various electrolytes in solution, and by passing the current through it I had the same results. It was also evident to the observer that the changes that took place at the two poles were very different. Around the anode there was a firm coagulum, the result of the combinations of the various electro-negative elements, as the acids, etc., both with the metallic electrode and the albumen of the egg, while at the cathode the electro-positive elements were escaping in the form of gases, etc. Now the hypertrophied tissue of a stricture contains these various electrolytes, which are decomposed by the current in the same way, and the elements are either eliminated as gases, and pass out through the urethra (which I frequently feel in passing a strong current), or are absorbed by the blood. You can readily understand now why the urethral electrode is always attached to the cathode, because, should you reverse the current, you would not only not benefit your patient, but do incalculable damage by causing new deposits in the urethra, and a worse stricture than you had at first. The advantages of this operation over others are that it is almost painless, that it is seldom or never (when cautiously handled) followed with any inflammation or after-trouble, and that, *in my opinion*, the cure is permanent."

From these reports any ordinary intelligent person can learn the principles and theory and practice of electrolysis in stricture.

In the treatment of impotence, when it depends upon urethral stricture, this is *the* treatment for a radical cure. If healthy sexual function does not return upon the cure of the stricture, then the method described in a former chapter should be adopted.

CHOREA.

On page 54, under the head of central galvanization, chorea is mentioned as one of the diseases amenable to this treatment, and with certain precautions and modifications we are prepared to commend it highly.

Powerful batteries are not required for successful treatment of this kind. Indeed, we are apt to use electricity too strong in these cases, as well as in many others, and then evil instead of good results are always realized.

We use galvanism only in chorea. So far as our experience

goes, the faradic and static forms of electricity are not so effective here. We use large sponge electrodes, and very mild currents—from two to eight cells, according the age and impressibility of our patients. Children from five to seven years of age rarely bear without complaint more than two to four cells; and older patients—nine, twelve and sixteen—will not require more than four, six or occasionally eight cells of an ordinary Stohrer, McIntosh, or Daniell. While there is greater quantity in the Daniell, the action is not so quick, and the current milder, and patients can bear more cells from this battery than from others. But the fourteen-cell bichromate battery, double-size elements, as made by Aloe & Hernstein, answers a fine purpose.

In making the application, the sponge electrodes should be well wetted with water, and the hair on the head of the patient should be moistened also. Salt water is preferred for these purposes by some, but we can get all the effect we want in using plain water, and it is more convenient. Now, if the chorea is confined to one side of the body only, the positive pole of the battery is placed on the side of the head, above the ear, opposite to the affected side of the body, and the negative electrode placed in the hand of the affected side. This is all done while the battery is at zero. After the electrodes are properly fixed, we take into the circuit one or two cells at a time, till two, four or eight cells are included, as may be required, carefully observing the behavior of the patient, that we may avoid the results of too strong currents, or too long continuance, as per cautions given on page 53. It is a good practice to test the impressibility of these patients as described on page 52. From three to six minutes is long enough for any application of this kind, and they should be made daily.

If both sides of a patient are involved, then we should apply the treatment to both sides alternately—a minute or two on one side, and then a minute or two on the other side. In changing from one side to the other, we should disconnect the battery, or turn it to zero before we remove or change the sponges. This is done to prevent a shock in breaking the current by suddenly lifting the sponges.

Under this treatment alone nearly all chorea patients begin to

improve at once, and if the treatment is continued, in harmony with other appropriate therapeutic measures, such as the judicious use of arsenic, cimicifuga, chloral, etc., we need not fear of success. While we might cure with medicines alone, our observation warrants us in stating positively that with the additional use of electricity this disease is materially shortened, and the cure made comparatively easy.

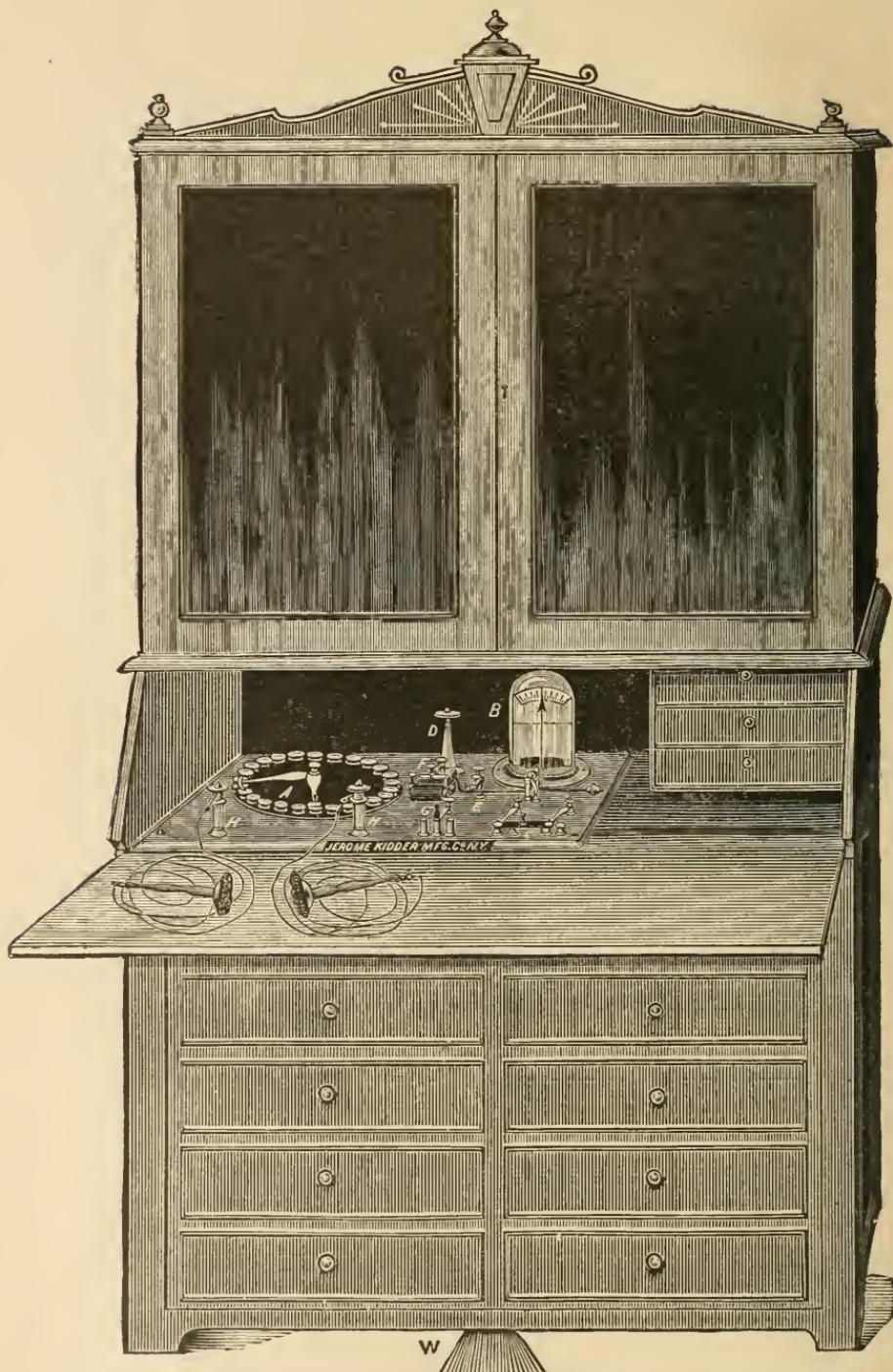
A WORD TO BEGINNERS.

All physicians, before commencing the use of electricity, should remember that this agent will not cure everything. In fact, there are many cases in which it is not available, and instead of being useful it may do much harm. Again, in all cases where its proper application might prove beneficial, it should be used by a skilled hand, or administered by one who is quite well acquainted with the instruments employed, and the effects of the currents generated by them. The practice of putting electricity and electrical instruments into the hands of the people, to be used hap-hazard, as domestic remedies, should be discouraged, even prohibited. Just as well put any other potent remedy in their hands, and tell them to go ahead, for no measure employed by the medical profession requires more skill and experience in its successful employment than electricity. The common use of electricity by the people, all over this country, mostly by means of very cheap and inefficient instruments, can only result in disaster to nearly every patient who suffers such quackery to be imposed upon him. And, in many cases, where the good results looked for are not realized, electricity is held responsible, when, in fact, the measure itself is not to blame. The use of electricity should be confined to the medical profession, and its members should thoroughly understand it, and always use the very best instruments to be had. When this comes to be the condition of things, then electricity will be fully appreciated, appropriated when it may do great good, and avoided when it can only do harm. It is to be hoped that every intelligent physician in the country will discourage the foolish practice of advising *families* to buy batteries, and use them upon

the different members of the household who may happen to complain of pains and aches here and there. Such a practice is exceedingly reprehensible.

To succeed in the use of electricity, it is not only imperatively necessary that the operator understands the instruments used, but that he has a good knowledge of the disease he undertakes to treat; and then he must give the matter his personal attention. And it should also be remembered that time is required in bringing about favorable changes with electricity. It is true that much good may result from a few applications of electricity, but we more frequently find that great changes and permanent good result from the long continued and patient use of this measure. Patience is positively required in the use of this agent; and unless operators have sufficient faith, and the patient confidence to continue treatment for any reasonable length of time, it is hardly worth while to commence. These are the essential requisites in the use of electricity, and if properly observed, there is enough in this volume to guide any intelligent physician in the successful application of this great therapeutic measure.

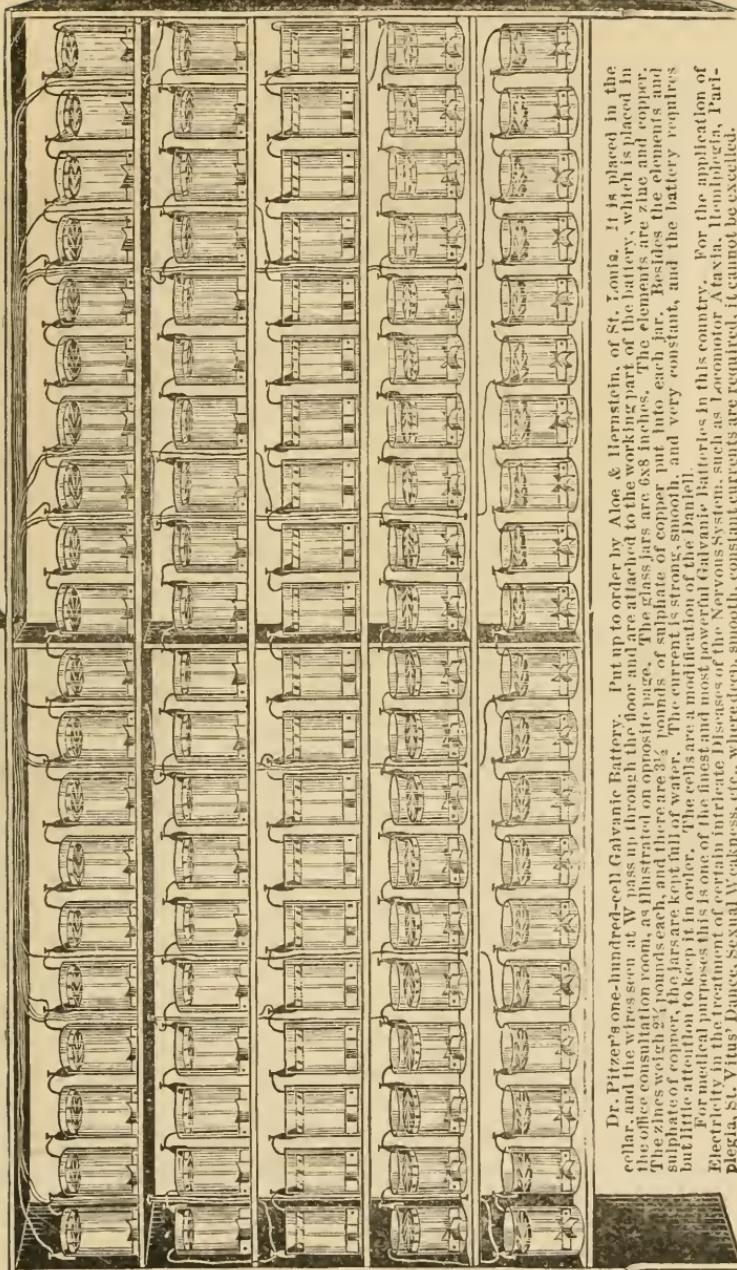
DR. PITZER'S ONE-HUNDRED-CELL



This is the working part of Dr. Pitzer's one-hundred-cell Galvanic Battery. The stand mechanism was made to order, by Jerome Kidder Manufacturing Co., of New York city. It is fixed in a suitable cabinet, and has every convenience required. The arrangement is such that by properly moving the arms on the compound circle switch, A, any desired number of cells, adding four at a time, may be taken into the circuit. Or any number of cells in any part of the circuit may be used at pleasure. (At W the wires are seen coming from the Battery in the cellar.)

GALVANIC BATTERY.

W



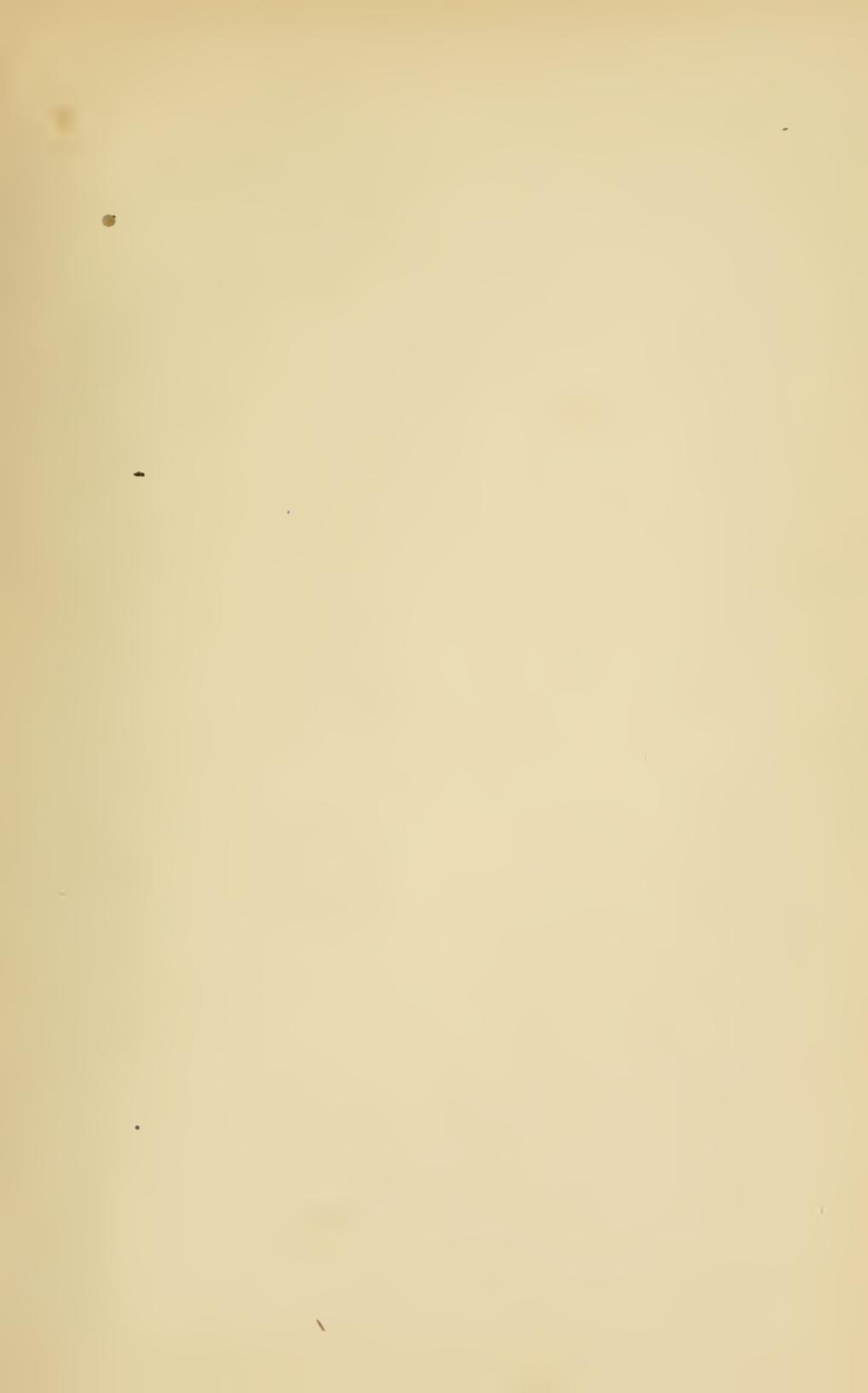
Dr. Pitzer's one-hundred-cell Galvanic Battery. Put up to order by Aeo & Hartenstein, of St. Iona. 114 placed in the collar, and the wires run through the floor and are attached to the working part of the battery, which is placed in the office consultation room, as illustrated on opposite page. The glass jars are 68 inches. The elements are zinc and copper. The zinc weighs $2\frac{1}{2}$ pounds each, and there are $3\frac{1}{2}$ pounds of sulphate of copper put into each jar. Besides the elements and sulphate of copper, the jars are kept full of water. The current is strong, smooth, and very constant, and the battery requires but little attention to keep it in order. The cells are at a modicum of the hand.

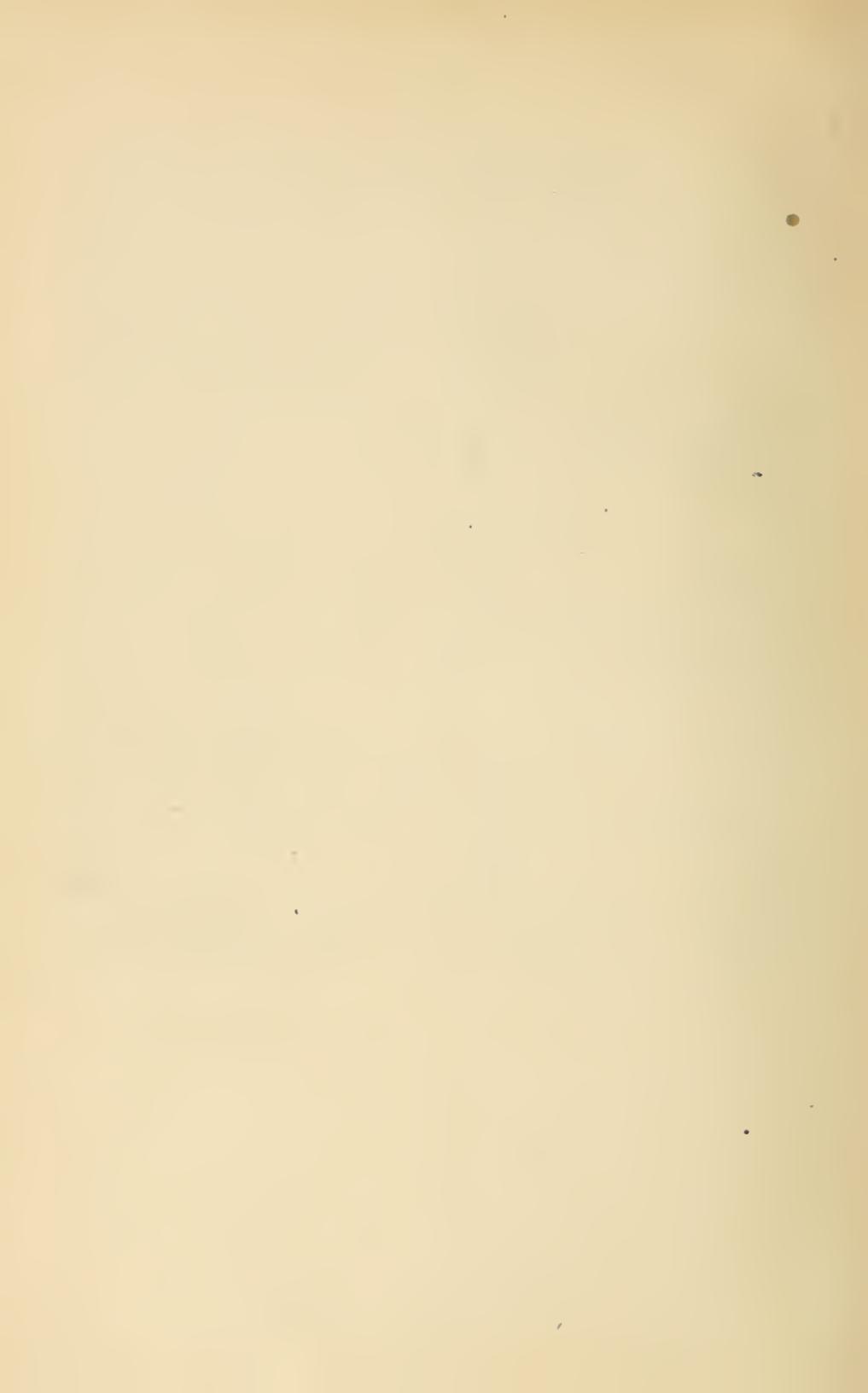
For medical purposes this is one of the finest and most powerful Galvanic Batteries in this country. For the application of Electricity in the treatment of certain intricate Disease of the Nervous System, such as *Locomotor Atrophy*, *Hemiplegia*, *Paraplegia*, *St. Vitus' Dance*, *Sexual Weakness*, etc., where deep, smooth, constant currents are required, it cannot be excelled.

INDEX.

PAGE.	32
A Word to Beginners.....	180
Acne	73
Aloe & Hernstein's Galvanic Battery	10, 11
Aloe & Hernstein's Improved Electro-Magnetic Machine	22
Amaurosis	73
Amenorrhea	73
An Impostor Exposed.....	85
Asphyxia—How to Relieve	91
Atkinson's Topler Electric Machine	123
Bartholow's Method for Producing the Static Induced Current..	109
Bartlett's Galvanic Battery.....	11, 12
Battery Elements	7
Battery Fluid for Zinc and Carbon Elements.....	7
Battery Fluid for Smeé Elements..	19
Cases in Illustration of Asphyxia Patients	92 to 96
Central Galvanization.....	52
Chloroform Anaesthesia—How to Manage	91
Chorea	54, 178
Commutators.....	10
Conduction and Induction.....	7
Conductors and Conducting Cords	10
Dana, C. L., M.D., on Impotency..	142
Dangers of Strong Currents	53
Death—Testing for Life or Death in doubtful cases.....	87, 88, 89, 90, 91
Drowning—How Treated with Electricity	91
Dr. Hathaway's Electro-Magnetic Chair	26, 49
Dr. Pitzer's One-Hundred-Cell Galvanic Battery	182
Dr. Romaine J. Curtiss on the Value and Use of Static Electricity	110 to 115
Dr. W. J. Morton's Clinical Experience with Static Electricity.....	115
Electricity—what is it?	3
Electricity, Different Forms of	5
Electrodes	10
Electro-Therapeutics.....	32
Electricity as a Stimulant, Tonic and Sedative	32
Electricity in Diagnosis.....	34, 35, 37
Electrolysis	55
Electro-Diagnosis	81
Electrodes for Static Machines Illustrated	132 to 135
Eye Electrode, or Electro-Magnet.	136
Eyes—the Effects of Electricity upon	83
Facial Paralysis.....	34
Facial Paralysis, Complicated.....	36 to 38
Facial Paralysis.....	78
Faradic Machines	18
Faradic or Induced Current	18
Faradic or Induced Current Explained	21, 22
Faradization, Local and General....	33
Forms of Static Electricity.....	105
Franklinic or Static Electricity	6
Gaiffe's Pocket Electro-Medical Apparatus	25
Galvanism	6
Galvanic Battery Cells	7
Galvano-Caustic Electrodes and Instruments	17
Galvanometers and Galvanoscopes	28, 29
Galvanism to Relieve Pain	42
Galvanic and Faradic Current both Necessary	41
Galvanism and Faradism Compared	46
Galvano-Cantery and Galvano-Cautery Batteries	96 to 99
General Effects of Electricity.....	4
Gross, Prof. S.W., M.D., Urethral Stricture and Sexual Weakness..	151
Hairs Removed by Electrolysis.....	59
Heart Disease	45
Hammond, Prof. Wm. A., on Impotency	143
How to Administer Electricity Properly	41
How to Succeed with Electricity....	181

Hutchinson, Wm. F., M.D., on Impotency	141	Poles	6
Hysteria	54	Positive and Negative Static Electricity.....	131
Hysteria and Spasm.....	116	Pressure Paralysis	120
Impotency	139, 151	Prof. J. O. Stillson's Cases in Eye Surgery	137, 138
Induration	75	Pulmonary Disease.....	45
Insulators	10	Quantity and Tension or Intensity	8
Insulation	106, 131	Queen's Toepler-Holtz Machine	100
Kidder's Improved Cells for Tip Batteries.....	20	Rheotomes	30
Kidder's Physician's Office Electro-Medical Apparatus	24	Rheostats	31
Kidder's Physician's Visiting Machine	25	Rheumatism	75
Kidder's Pocket Induction Apparatus	26	Rheumatism	112
Lead Poisoning	74	Rheumatism, Muscular	118
Liver Disease	44	Romaine J. Curtiss, M. D., on Static Electricity.....	104 to 105
Loadstone	5	Sciatica	42, 44, 111, 112
Local Atrophy	76	Sciatica and Cruralgia	119
Locomotor Ataxia.....	120	Sensitive Parts of the Body to Electricity	82
Lumbago.....	74	Sexual Weakness.....	139
Malingeringers—How to Detect them	84	Skin Diseases	71
Magnetism	5	Smee's Elements	19
McIntosh's Galvanic and Faradic Batteries	12, 13, 14, 15, 16	Sparks	106 to 109
Mothers' Marks	76	Spinal Curvature	47
Nervous Headache	43	Static or Franklin Electricity.....	99
Neuralgia—the Proper Current to Use	40	Static Induced Current	109
Neuralgia of the Head	43	Static Induced Current as a Tonic	114
Neuralgia, Complicated	113	Static Electricity and Ozone	135
Newman, Robert, M.D., Urethral Stricture and Electrolysis	153	Stohrer's Galvanic Battery	6
Obscure Diseases	55	Tasting Electricity.....	83
Opium and Morphine Narcotism.....	91	The Wrong Current	77
Overall, G. W., M.D., Urethral Stricture and Electrolysis	176	Toepler-Holtz Machine	100
Paralysis of Leg	78	Trance—How to Distinguish from Death	87
Paralysis, Central and Peripheral..	84	Trouve's Polyscope	98
Paralysis, Bell's	119, 120	Tumors Removed by Electrolysis..	56
Peripheral Paralysis, Tests for.....	34	Uniting Cells for Tension or Quantity	9
Piffard's Galvano-Cautery Battery	16	Urethral Stricture	151
Polarity of Electricity.....	5	Very Strong Currents Injurious	39
Poles—Positive and Negative	8	Which Pole to Use	49





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